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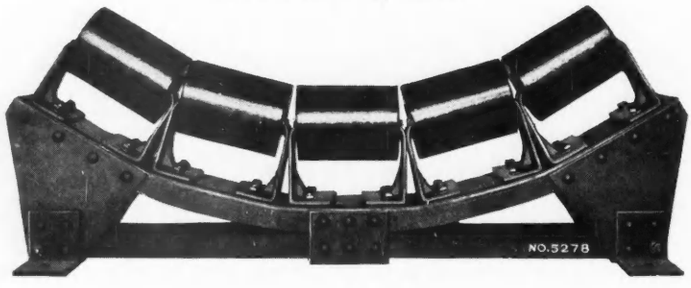

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JOSIAH EDWARD SPURR, Editor

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Pittman Act Silver

SILVER MINERS of the United States stand to lose the tidy sum of about $3,400,000 by the latest ruling of the government regarding the operations of the Pittman Act—the difference between the world market and the dollar price on 10,000,000 oz. of silver. As announced by the Director of the Mint last week, the purchases of silver still to be made by the government are not so large as generally anticipated—not so large by some 20,000,000 oz. Of this amount 10,000,000 oz. is held to represent silver in process at smelters and already tendered, or about to be tendered, to the mint; the other half is represented by silver allocated to the Director of the Mint and used to coin subsidiary silver pieces—half dollars, quarters, and dimes. In all, 270,121,554 silver dollars were melted, containing 208,922,138 oz. of silver, of which 11,000,000 oz. was used in manufacturing subsidiary silver; the rest was shipped abroad or used to stabilize Far Eastern exchange.

Until now, most of us had been led to believe that the repurchases of silver by the government were to include the subsidiary coinage allotment, an inference substantiated by official statements. To quote from the 1920 annual report of the Director of the Mint: "The act provides for the repurchase of the same quantity as contained in the dollars melted, about 208,000,000 ounces fine." Plain words, aren't they? After proceeding serenely under the assumption that these words and similar pronouncements meant what they said, the recent statement of the Director of the Mint was perturbing, to say the least, as it cuts down the total purchases to 198,000,000 oz. Why the new ruling? No adequate explanation has been forthcoming, and the eleventh-hour change has not met with favor from the miners, who are naturally irritated at the short notice.

That Senator Pittman, the author of the act, understood, with the rest of the world, that the amount of silver to be repurchased was 208,000,000 oz. is shown by the following excerpt from his statement of April 28, 1921, before the Mining and Metallurgical Society of America:

"The Pittman Act will not be repealed. The question is how long will it be operative. Two hundred and eight million ounces of silver were sold under the bill. Fifty million ounces have already been replaced. Our country in 1920 produced fifty-six million ounces. It is estimated that by reason of the closing down of the copper mines we will produce only thirty million ounces in 1921. You can estimate how long it will take to replace the remaining one hundred and fifty-eight million ounces."

For many months we, in common with other publications, have been printing, for the guidance of all concerned, the amount of silver remaining to be purchased under the Pittman Act, basing our estimate upon government reports that altogether approximately 208,000,000 oz. were to be bought. If we have misinterpreted the laws and regulations covering this phase of governmental activity, why were we and others not corrected months ago? Some inkling should have been given the silver-mining industry that things were not as they seemed.

We have failed to discover the reason for declining to consider the "subsidiary coinage" silver as part of the lots to be replenished by the present purchasing of the government. The silver was taken from the stocks originally held by the Treasury Department, and surely it was the intention of the Pittman Act to terminate the purchases only when the amounts of silver used were replaced in their entirety. That was the spirit of the legislation. Although 10,000,000 oz. is only about two months' production of the United States and 5 per cent of the total amount to be bought, the lopping off of this sum will be felt keenly by many mining companies.

Tenders of silver are to be accepted by the government in lieu of actual delivery of silver bullion at the mints. This arrangement adversely affects silver-mining companies (cyanide plants) that do not depend upon the smelting companies to handle their production, but treat it themselves. They may justifiably complain, as their silver bullion, which is recovered quicker than that of the custom ore producers, cannot take advantage of the circumstances, because silver in ores and concentrates of other producers can be tendered to the mint in that form through the smelters and can compete for the government price. Thus, about 95 per cent of the domestic production is assured an equitable deal.

Considering the short time before the repurchases are expected to end, the details should have been threshed out months ago. This applies particularly to the construction of the act in its relation to the coinage of subsidiary silver. The government has been lax in allowing the matter to drag until a belated last-minute proclamation was made. All the confusion that has resulted could have been avoided by an earlier warning.

Beware of Platinum

ANOTHER OPPORTUNITY is offered for investing in a mine—two mines in fact—that are said to produce rich ore of platinum and iridium. To quote the *Spokane Daily Chronicle*, which spreads the information clear across the top of the front page of its issue of March 22, the assay results of the local chemists have been verified by "several assayists of eastern specialists." The analyses vary from $116 to $569 per ton. A concentrator is to be built jointly by the Cariboo and Wilson mining companies, and a refinery will be built to handle the concentrates. The scene of these operations will be Coeur d'Alene Lake, situated 45 miles south of Spokane. This should not be confused with the Coeur d'Alene region of Idaho.

We hope that rich platinum ore has been found, but we do not believe that it has been. This is another instance where the only assayers who have been able to detect the presence of platinum use mysterious methods;

and several reputable customs assayers have tried in vain to find platinum in samples from the same lode as that from which the alleged rich ore is being obtained. The U. S. Bureau of Mines, in Bulletin 270, has described a fire method for assaying for platinum that has the stamp of approval of many reputable chemists from all over the country. The ore in question, we are reliably informed, does not yield any platinum when subjected to the treatment outlined in this bulletin. That does not prove conclusively that there is no platinum in these ores. However, the following facts are significant: During the last twenty years the discovery of rich platinum ore in different western states has been reported at least a hundred times; it has invariably been admitted that fire assays would not detect the presence of the precious metal, but that secret "chemical" methods of analysis had to be employed; but—here is the crux of the thing—we have never yet heard of a single ounce of platinum bullion being obtained from the treatment of these mysterious ores. What good is platinum "ore" in which the platinum eludes the man who tries to recover the metal for market? Frankly, we are skeptical of these latest reported finds.

The Light That Failed

THE GEOLOGICAL SURVEYS of the United States and of the several states are called upon to investigate and explain many things, from the best place to sink a well to the platinum reserves of Pennsylvania. Not as often are they called upon to investigate and analyze a mysterious light, as the Geological Survey in Washington was commissioned to do recently. Which shows the progress of science. Up till half a century ago, they would have sent for a priest, and abiding legends of miracles, and the undisputed proof of a religion, would have been built upon a great light shining in darkness upon a mountain top in North Carolina.

Brown Mountain, Burke County, North Carolina, has for many years been, according to common reports, thus mysteriously lighted. The Survey bulletin states "Some have thought that these lights were of supernatural origin; others have dreamed that they might indicate enormous mineral deposits; and many who have not had such visions have looked upon them as a natural wonder that lent interest to all vacation trips to the region."

In 1913 these lights were investigated by the Geological Survey at the urgent request of a North Carolina Congressman. Nothing unusual was found; but the lights were nevertheless seen thereafter. Finally, Senators Simmons and Overman, of North Carolina, prevailed upon the Geological Survey to make a second examination and report. This report as made represents the combined talent and scientific research of the United States Geological Survey (five geologists), the United States Weather Bureau, the United States Forest Service, and all the host of state and local amateur investigators and wiseacres.

The first published account of this mysterious phenomenon appeared in the *Charlotte Daily Observer*, Sept. 23, 1913:

"The mysterious light that is seen just above the horizon almost every night from Rattlesnake Knob, near Cold Spring, on the Morganton road . . . is still baffling all investigators. . . . With punctual regularity the light rises in a southeasterly direction from the point of observation just over the lower slope of Brown Mountain, first about 7:30 p.m. and again at 10 o'clock. It looks much like a toy fire balloon, a distinct ball, with no atmosphere about it. . . . It is much smaller than the full moon, much larger than any star and very red. It rises in the far distance from beyond Brown Mountain, which is about 6 miles from Rattlesnake Knob, and after going up a short distance, wavers and goes out in less than one minute."

Later it became the custom to organize expeditions to study the Brown Mountain Light. In 1919 the problem was brought to the attention of the Smithsonian Institution and referred by it to the United States Weather Bureau. From descriptions and letters the Weather Bureau decided, though without investigation, that the light was an electrical discharge similar to the "Andes Light" of South America, where the towering peaks serve in a measure as lightning rods. This explanation of the Brown Mountain Light was the subject of a paper before the American Meteorological Society, and this became the subject of a bulletin of the National Geographic Society, although without investigation. Other theories put forward were that the light was a will-o'-the-wisp—that is, due to marsh gas; that it was due to phosphorus, in some unexplained manner; that it was due to "fox fire" or phosphorescence; that it was due to radium emanations; that it resulted from chemical reaction between hydrogen sulphide and lead oxide; that it was the light from the stills of moonshiners; that it was a mirage; and that it was the reflection of locomotive and automobile headlights.

The investigation by the Geological Survey in 1922, made by Mr. George R. Mansfield, was made over a period of two weeks on the spot, and with scientific thoroughness. Geology, topography, and atmospheric conditions, as well as the time-tables of trains and the location of automobile roads, were investigated for underlying data, and a plane table, a telescopic alidade, a barometer, and a camera formed part of the exorcising equipment. From the psychological standpoint (most important of all) the investigator was assisted and checked by local observers long familiar with the lights; and what these local observers remarked from time to time during the investigation is quite properly set down as applicable data.

The conclusions of the geologist who was called upon to investigate the dancing lights in midair above a mountain peak are disappointing. We shall never make a legend, set up a myth like Hawthorne's Great Carbuncle, or found a new religious Brown Mountain sect upon such dry facts as he gives. He says,

"The writer feels confident that the lights he saw were actually a fair average display of the so-called Brown Mountain Light. He not only has Mr. Loven's word to sustain this conclusion, but he is certain that the lights he saw agree closely in appearance and behavior with those originally described in the *Charlotte Daily Observer* and by Prof. Perry."

He finds that the lights originate not on the mountain but in the broad valley some miles away. They have nothing in common with the "Andes Light." Electric headlights on railway locomotives and automobiles seem to furnish the chief source of illumination. Of the twenty-three lights noted by the investigator by instrumental observation, seven were proved to originate from locomotive headlights after instrumental calculations and comparison with train schedules.

"In summary it may be said that the Brown Mountain Lights are clearly not of unusual nature or origin. About 47 per cent of the lights that the writer was able to study instrumentally were due to automobile headlights, 33 per

cent to locomotive headlights, 10 per cent to stationary lights, and 10 per cent to brush fires."

Does this dispose of the Brown Mountain Light? In scientific circles, doubtless, even though the Weather Bureau, the Meteorological Society and the National Geographic Society may hem and haw and look wise and recalcitrant. But in North Carolina—never. An explanation which robs the locality of all its glory gradually accumulated since the Civil War, and harshly dispels the mirage of a mountain of radium, as the least romantic possibility, will never be a popular one. About 1933 Senator Bingo, of North Carolina, will produce some signed affidavits of Colonel Brashears Montgomery, of Charlotte, and have a bill passed to have a permanent station of the Geophysical Laboratory located at Brown Mountain. Even before that time, doubtless, local capital will raise a company to tunnel under Brown Mountain and sink a deep shaft under its center. And as a reason for throwing out the Mansfield report, they even may quote the words of a deservedly obscure Washington poet, who has written of the episode:

"Way down in Caroline they were seeing things at night,
And needed a geologist to come and set them right,
Now Mansfield is a temperate man and never takes a drink,
So G. O. Smith he said to him: 'You are the man, I think;
Go down and find out what it is that makes them fellers blink!'
"So all one night poor Mansfield sat upon the mountain top;
He got so cold, at last he said: 'Well, thank you, just a drop.'
In his report he said: 'At first, just darkness did I see,
When suddenly the lights shone out in all their brilliancy—
And sometimes I saw six or eight, but mostly two or three!' "

The Government Takes a Hand

MANY ARE HELD in Texas as oil swindlers by the federal authorities, the daily press announces. This cheers the honest citizen and reassures him that the Great White Father at Washington is really watching out for him even when he takes a flyer on a hundred-to-one shot in the hope of reaping wealth. It confutes the cynic who has been firmly of the opinion that we are all headed straight for perdition. And the next time that there is a tremendous boom about something or other, and values are shooting skyward and stock is selling like icewater in the lower regions, many will jump in blithely up to their necks to get their share because they will know that all must be O.K., since all the naughty crooks and fakers are in jail or hiding.

The interest of the government is quite proper. It is its duty to stop the use of the mails for fraudulent purposes. But it is somewhat late in getting into action. Indeed, it is quite like locking the stable after the horse is loose. For the last four years and more the leading newspapers of the Southwest have been reeking with the advertisements of oil promoters that bore evidence on their face that little if any of the money they might attract would ever be spent on actual oil development. Furthermore, during the same period the mails have been widely used for distributing the prospectuses of these same individuals. Much literature of the sort, filled with extravagant statements that were ridiculously untrue, has been received in this office. Yet the government remained blind and inactive—seemingly so at least—and in the meantime, the public was fleeced of millions in playing a game that was framed against it. It was not until one S. E. J. Cox, who had been conducting a vigorous sale of oil stock, turned his attention to potash and said things that clashed with statements of the Geological Survey, that the government seemed to awaken to what was going on. Some time later Mr. Cox was arrested in New York, taken to Texas to answer charges, and then let go for lack of evidence. Now, if the papers are correct, Mr. Cox is but the subordinate of Dr. Cook, of North Pole fame, who has been very busy in Texas with the most up-to-date schemes for swindling.

Better late than never. Though beginning tardily, the government can well continue, at least to the extent of keeping its postal inspectors on the job where they belong. This will not cure the evil, but it will be a deterrent, and that will help. For the present, the large part of the golden harvest has already been reaped, but there will be other booms. Just as honey draws flies, booms attract get-rich-quick swindlers, and oftentimes it is the swindler that starts the boom. On this ground every boom should receive the careful scrutiny of the postal authorities.

Reciprocity in the Dissemination of Information

A COURTEOUSLY WORDED REQUEST for permission to describe the operations of a company that is mining an important industrial mineral was met recently by an unqualified refusal, the executive in charge explaining that pioneer work had been done, and that the publication of details might be of benefit to rival concerns. To such an attitude there can be only one reply: That secrecy in industrial operations will eventually defeat its own ends. Furthermore, while such a policy is being pursued, the more progressive section of the industry will bestir itself and take every possible advantage of the enlightened publicity that is possible in consequence of the facilities available for the recording and dissemination of technical information; in short, it will achieve a reputation for frankness, which is an estimable quality; its engineers will acquire distinction merely by reason of association.

At first sight it may seem unreasonable that anyone other than the pioneer or the inventor should benefit from individual or corporate initiative, but second thought provides ample proof of the stupidity and the impracticability of this attitude. In the first place, all human effort is co-operative. We owe our position in life and our achievements, in no small measure, to our ancestors—to the customs they established, to the benefactions in word and deed and substance they made for future generations. How can we repay this except by an attitude of generosity toward our contemporaries and successors?

Disregarding the morality of the issue, however, we maintain that secrecy connotes poor business acumen. It were well for the industrialist who prides himself on his uncommunicativeness to remember that, although he may temporarily prevent the entry into the field of a competitor, he is depriving himself and the company he represents of the moral support of the profession as a whole. History, over and over again, shows that a spirit of secrecy is invariably and quickly challenged by the appearance of initiative and inventiveness elsewhere, and that the loser in the game is the one whose feeble effort to dam rather than to utilize his share of the stream of progress results only in advantage to others. Successful secret technology, like secret diplomacy, is a thing of the past.

The Plight of the Prospector

By T. A. Rickard

RECENT LETTERS in our columns prove that the diminution in the number of prospectors and the decreased chances of making money by prospecting are subjects of immediate interest to the mining fraternity. The prospector has not "disappeared" yet, as is observable whenever a locality comes into the glare of publicity, but his ranks are thinning so fast that it is proper to inquire into the causes; for the prospector is the pioneer of mining, and prospecting is the first step in the making of mines. The inference that the chances of discovery have been exhausted betokens a lack of knowledge concerning the hinterlands of mining. The unexplored regions are still extensive; there remains plenty of room for intelligent prospecting: the Arctic and the Tropics alike still contain much undiscovered ore, pinned under snow or veiled in jungle. Canada and Siberia, central Africa and equatorial America, contain big tracts that know not the miner's pick. Old mines, like the Chino and the Ray, may be reopened, and on them large productive enterprises may be based; but in the last resort the continued expansion of the mining industry depends upon the finding of fresh prospects. For that we look to the prospector. Some say that the day of the old-fashioned unscientific seeker for ore is gone, and that the mines of the future will be found by means of scientific search under the direction of the geologist and his technical associates. That is only partly true. We judge the future by the past; the discoveries of the last thirty years have not resulted from scientific search; for example, Cripple Creek, Goldfield, Cobalt, and Porcupine. Individual deposits may have responded to the scientific touch, as those of the Mandy and Miami mines; but they are exceptional, and both of these owed something to the unpretentious prospector that brought the mining geologist on the scene. It is true, luck will play less part in the future because of a diminution in the number of rich outcrops that lie exposed to the casual seeker; most of them have been located, in both senses of the word. Successful prospecting will call more and more for systematic investigation, including mapping and geologizing, and for technical methods outside the ken of the average prospector.

In a letter on this subject, Mr. Thomas A. Blair lays stress on the prospector's diminishing chances of making money, because prospects are subjected today to a severer inspection than they were in the past, and money is not paid by the speculator with the same joyousness as of old. That is true. The mining public, despite the periodic crop of simpletons, is more sophisticated than it used to be, thanks, I think, to the technical press. Prospects are not bought by cheerful adventurers on the spur of the moment; on the contrary, an examination by a cautious engineer invariably precedes an agreement to purchase. Large sums in cash are not paid after a hasty visit to a prospect, because a small payment suffices to obtain an option for a period long enough to permit further exploration, to which so many nice-looking prospects succumb. The operation may be said to be successful, but it injures the health of the prospector. That is why he looks askance at the young mining engineers of today; to him the modern technician is a spoil-sport, if not worse. He imagines the mining profession to be his enemy; but in this he is mistaken. He is simply the victim of a collision between the old spirit of careless adventure and the new spirit of sagacious enterprise. So I grant that the lessening chance of beguiling an undiscriminating speculator provides one of the reasons why the prospector's calling has become less remunerative; another is the variety of mining enterprise, which calls for a more extensive knowledge of minerals and ore deposits. Formerly the precious metals were the object of search almost exclusively. Now it is the base metals, and sometimes the rare earths. The ordinary prospector is not familiar with such minerals; problems arise that baffle him. How is the old-fashioned prospector to appraise a low-grade copper deposit, such as is the basis of the big mine of today? A prospect to be remunerative to its finder must be the source of livelihood; in the old days the prospector could pan gold from a placer or dig "chloride" for shipment on his burro to the nearest smelter. The low-grade lead or copper deposit that makes the big mine of tomorrow is a white elephant to Tom or Jim on the hills; he cannot afford to camp there until it is marketable, for that stage may not be reached until a million tons of ore has been proved. So the big battalions are too much for our old friend of the pick and gad, of the pork and beans. Another factor unfavorable to the prospector is a decrease in grubstaking by local storekeepers and merchants, who, in the spacious days of early Western exploration, furnished the prospector with his supplies and equipment in return for a half share in any discovery he might make. This backing by local tradesmen was an important phase of prospecting twenty or thirty years ago.

The prospector graduates from the mine; he is a former wage-earner who has been caught by the spirit of adventure and led into the hills by the lure of the unknown. For example, every spring in the North many men that have been earning wages during the winter will sally forth soon after the "break-up" and go "on the mush" up the creeks into the wilderness outside the camp. To most prospectors the occupation of mineral exploration is a seasonal one; it is one to which they devote the summer. During winter they save enough from their wages to make a grubstake. Next, it must be noted that our miners of today are different from those of twenty or thirty years ago, when the names on the payroll were easy to pronounce, indicating that their bearers were Cornish, Irish, Welsh, or American, many of them the sons and grandsons of miners. Besides, an inherited taste for mining connotes the spirit of adventure that has carried the language of Shakespeare to every corner of the earth. I desire to avoid exaggeration, but I submit that the old-time British or American miner was naturally a prospector because he had the spirit of mineral adventure. Today the mines of the United States are worked by men of other origins, not only of foreign blood but with ideas foreign to the spirit that sends the prospector on his quest. The Mediterranean peoples, from whom our miners are now recruited, do not feel the call of the wild; their ideal is a hut and garden, or a home and an orchard; to them mining is a temporary business.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Why the Furore About Arsenic?

THE EDITOR:

Sir—Twenty years ago we produced in the United States 300 tons of white arsenic; in 1910 we had gone up to 1,800 tons, and in 1920 our production was 11,502 tons. Yet we face a deficit in production this year. We are told that the year's requirements will be in excess of 12,000 tons and that our available supply in May will be under 5,000 tons.

If the reader is following the papers and reports closely he may be confused with regard to the situation unless he understands what is back of it all. The farmers are calling frantically for arsenic, and Congress is proposing that the government buy huge quantities and sell it to the growers at cost. Other interests are trying to assure the public and the backers of new arsenic enterprises that there is no shortage, and that this is merely a flurry. Perhaps the entomological side of the story will help the mineral and chemical interests to understand some of the reasons underlying all of this tremendous stir about arsenic.

Prior to 1900 no arsenic was produced in the United States worthy of note, and the total imports in all forms varied from 2,000 to 3,000 tons per annum. Up to this time london purple and paris green were the standard insecticides, being used on potatoes, tobacco, cotton, and fruit trees, and were largely imported. If we look at the statistics of imports of these two arsenicals we find them increasing until 1906, and from that time on steadily decreasing, although both imports and native production of arsenic in all forms was in general on the increase. Paris green began to go into the discard in 1904, and in 1909 had been supplanted by lead arsenate in the recommendations of entomologists. Lead arsenate first came into use as a spray, but Wilmon Newell's announcement in 1909 of its value as a dust against the boll weevil was the beginning of the boom which arsenic has since had. Quickly following this, lead arsenate as a dust became the standard dusting insecticide for tobacco. In fruit and vegetable work lead arsenate as a spray remains the standard.

But in cotton boll weevil work, although lead arsenate is perfectly satisfactory, for certain reasons best known to a few of its advocates calcium arsenate has been boomed by governmental agencies and lead arsenate is largely lost from sight at present. The calcium arsenate is more toxic and at the time of its advocacy was cheaper than lead arsenate. Now the lead arsenate is becoming cheaper, because of the unprecedented drive for calcium arsenate.

Arsenic is the weapon with which American farmers are inadequately trying to fight insects doing over a billion dollars' worth of damage a year. Let me cite estimates of the annual damage from insects to crops on which we use large amounts of arsenic, with 1919 statistics as a basis. The figures are given in the accompanying table. They show only a part of the annual insect damage, which on the 1919 basis is estimated at $1,261,291,000. Arsenic, however, enters largely into the combative measures against the insects doing the damage tabulated.

Estimated Annual Losses Due to Insects

Animal industry	$175,000,000
Apples	7,474,500
Beans	1,213,000
Cotton	282,288,000
Fruits not specified	10,000,000
Nuts	1,000,000
Pears	347,000
Potatoes	236,541,000
Sugar beets	1,007,000
Sweet potatoes	1,709,000
Tobacco	6,972,500
Truck crops	10,000,000
Total from above specified crops	$733,552,000

In general, good practice calls for about 30 lb. of arsenate per acre on apples, cotton, pears, and tobacco, and from 2 lb. up, according to necessity, on the other crops. Arsenic is considered as crop insurance on the listed crops. Used on apples it increases the yield by from one to three bushels per tree. Tobacco that is eaten or ragged by worms is worthless for cigars. Dusting with lead arsenate is cigar insurance. Defoliating insects ravaging a sugar beet crop before the sugar content is up to standard may ruin a crop. Arsenic is sugar insurance. Potato growing where the potato beetle is present is hazardous, unless arsenic is used as potato insurance.

Ticks are responsible for huge losses to cattle in the South from Texas fever. Dipping the cattle in an arsenical dip and keeping them thereafter in a tick-free pasture is beef insurance.

The cotton boll weevil is doing business in the South at the rate of from $100,000,000 to $500,000,000 a year, which the farmers pay first and then assess upon us. In fact, so bad is the weevil that it has almost wiped out cotton growing in some districts, and in these it has been found that cotton can be grown and made to pay by dusting with calcium or lead arsenate at the rate of about 30 lb. to the acre. Arsenate, therefore, becomes cotton insurance, or, in other words, clothing insurance.

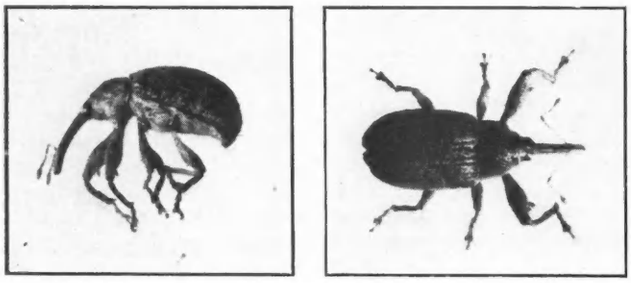
Can you not see that we owe to arsenic the saving of large quantities of our foods and clothing, and that if we had more arsenic we would insure larger available supplies of our necessaries of life?

But here comes the crux of the situation. We have never in any one year had more than 15,000 tons of arsenic available. If we were to protect our tobacco crop inadequately with only one annual application of just 5 lb. we would need 3,022 tons of lead arsenate. One 5-lb. poisoning of our potato crop would call for 7,373 tons of lead arsenate. Proper protection of the apple crop would require 32,465 tons, and proper insurance of the pear crop would mean 3,104 tons of lead arsenate. Then we would want 3 lb. per acre for our 225,754,285 grape vines; 2 lb. per acre for our cherries;

and more for our beans, asparagus, sugar beets, tomatoes, our walnuts and other products. We have to fight off the Argentine ants with arsenical syrups and the grasshoppers and cutworms with arsenical baits. We need 1,000 tons of arsenic for cattle dips, 1,500 tons for weed killers, 750 tons for the proprietary medicines and other compounds, and then must allow the glass industry its usual quota of 2,000 tons.

But in all this we have not mentioned the 30,000,000 acres of cotton on which we wish insurance, over 10,000,000 acres of which must be poisoned to make profitable crops. But if we allow only 5 lb. to the acre, instead of the nesessary 30 lb., on this badly infested region, we must have 50,000 tons of either calcium or lead arsenate.

Let us look at it from a different angle. The maximum amount of white arsenic produced and imported that has



The boll weevil—the bug that caused the price of arsenic to advance.

hitherto been available in any one year in the United States was 15,000 tons. This would make perhaps 24,000 tons of calcium arsenate, which at the standard rate of 30 lb. to the acre would cover 1,600,000 acres. We are not allowing any of the supply to go outside of the cotton fields. This would do but little more than save the 1,680,000 acres of Louisiana. It would not begin to give adequate insurance on the 2,628,000 cotton acres of Mississippi. These are only two of the states which suffer acutely every year from the weevil, and in which it is safe to say every acre should be poisoned as weevil insurance. Georgia, with its 4,172,000 acres, is grossly infested in over half of its acreage. Florida cannot raise cotton without poisoning, and its cotton raisers have suffered so much that their acreage is now cut down to 65,000 acres. Texas, with its 10,745,000 acres, is grossly infested in over half the cotton belt.

The utter inadequacy of our arsenic supply to meet this crying need of a suitable means of preventing insect damage cannot but be apparent. Nor can it be anything but obvious that no matter how much arsenic is produced there will be a potential market if the price is within the margin of practicability.

The growing demand for arsenic is due to a growing enlightenment on the part of the producers as to the value of insecticidal crop insurance. The demand for arsenic at normal prices will grow irresistibly until some better insecticide is found to take its place, or other methods of insect control are devised. The history of such new discoveries is that it takes a period of years to establish any new method of insect control. This is evidenced by the fact that the normal production of paris green is today 1,200 tons per annum, in spite of the fact that it has been displaced in many fields. No substitute for the arsenical insecticides is in the field now or is even being suggested. Those who enter the field of arsenical production have therefore before them at present a clear and open competitive field, with well-established standards to meet.

The government specifications for calcium arsenate are that it shall have not less than 40 per cent total arsenic pentoxide, but not more than 0.75 per cent water-soluble arsenic pentoxide, and that its density shall be not less than 80 or more than 100 cu.in. to the pound, if it is to be used as a dust against the cotton boll weevil.

Lead arsenate for boll weevil dusting should be of the dihydrogen form, with not less than 32 per cent total arsenic pentoxide, nor more than 0.75 per cent water-soluble arsenic pentoxide, with the same density as noted for calcium arsenate.

Lead arsenate for tobacco dusting should be of the diplumbic form, with not less than 30 per cent total arsenic pentoxide, and not more than 1 per cent water-soluble arsenic pentoxide, and should have the same density as the other specifications. Other than these requirements, insecticides must conform to the Insecticide Act, the rulings of the Insecticide and Fungicide Board, and the laws of the various states.

San Mateo, Calif. W. DWIGHT PIERCE.

Closing the Door on the Miner

THE EDITOR:

Sir—All miners and mining men are familiar with that period known as the Pacific Railroad Land Grant Age, which introduced a fault or fracture in the mining structure which has since been steadily and stealthily widening. It has intruded itself into the affairs of the little fellow and the big fellow; it has submerged the lone prospector and miner; and perhaps is affecting the corporation behind him. It is a thoroughly modern development—swift, sure, and deadly in its processes. There is still a fair-sized remnant of undevastated mineral lands left, and, in the hope of saving this from this destroying element, this warning is sent out.

It is probably too late to undertake to reclaim those sections of mining territory that have been buried under a deep flow of *law*, and their only place in this article will be as examples of what our experience and energies should guard against.

The origin of the condition under consideration is in the (in)famous Pacific Railroad Land Grant Acts, which granted to various companies every alternate section of land on each side of the right of way for a distance of twenty miles. In these grants Congress sought to exact a form of compensation to the public by fixing a maximum price at which the lands were to be sold to *bona fide* settlers in case of agricultural lands, and specifically reserved mineral lands on which the allotments by alternate sections might fall, providing for lieu lands to replace reserved mineral lands.

The reservation of these mineral lands could not be otherwise than general and inclusive of such lands wherever located and placed, and, until their mineral character had been tested and determined, the purpose was that they should stand as reserved and open to the mining public for prospecting and development.

It is well known that practically all of the surface deposits have long ago been discovered and worked. But it is probable that there are without doubt a great number of buried deposits exceeding in richness anything yet found. If judged by the circumstantial evidence of the surface, the lands containing them would be declared non-mineral. But no man can say that any

lands in such a section are not possibly, probably, and reasonably mineral, as the term is understood in the mining world. This applies to both gravel and quartz deposits.

Apparently relying upon the adverse evidence of surface examination, the land-grant companies are rushing to patent every acre that can be crowded through the Land Office; and a review of recent decisions in contests on the part of miners in districts with which I am familiar would seem to indicate that the Land Office has narrowed the definition of mineral lands to mean that a paying mine must be developed on disputed land to exempt it from land-grant company patent. The essential determining factor seems to be disregarded, and that is the character of the district and its history and production, and undue weight is attached to surface indications and the evidence in the development work in whatever stage of incompleteness it may be at the time of examination.

Such a policy is condemned by the fact of the existance of rich mines in California, which have been found through tunnels thousands of feet in length, or through shafts of great depth, in mountain ridges which carry no surface evidence of what has been found in them.

This is the menacing condition that confronts the present and future of mining and mining rights, and it is intensified by the activity of the land-grant companies in rushing patent proceedings on blanket areas of land in well-known mineral districts.

Let us note what follows the issuance of a patent to a land-grant beneficiary:

All public rights in such lands are vacated; the grantees are relieved of all conditions attached to the lands as originally granted; their right to do as they wish with their patented property becomes absolute; and thereafter extortionate prices are exacted for even remote mountain sections where mineral values are later found by some luckless prospector or miner (the man who goes before the engineer and the corporation), who has spent his time, money, and labor in developing a mine on what he thought was mineral land protected by the minerals reservation.

The present policy of the Land Office, as gathered from recent decisions, puts the burden of proof of *mineral values in paying quantities* on the *miner*, whereas it is clearly evident that the intent of Congress in the minerals reservation was the reverse of this, in not mentioning paying values or any particular feature as an identifying characteristic of the reserved lands.

A policy going to the other extreme, in line with the intent of Congress, would be more nearly just, sound, and logical. That is, a rule requiring the land-grant beneficiaries to prove beyond a doubt that no minerals exist in paying quantities in any lands sought to be patented; because, while on their part this would be an impossible requirement, it would be no more unreasonable than the present policy of requiring miners to prove the existence of paying values *before prospecting has been completed* in any lands on railroad grants that are the subject of patent application.

The miner's failure or, rather, inability to do the impossible means not only the loss of everything to him but also the loss of all public rights as well; while the land-grant company's inability or refusal to do an equally impossible act results only in its failure to substitute a patent right for a conditional right, but leaves all the surface privileges available to it under the land-grant acts.

In many parts of California and in other states, owing to patents issued to railroad companies, prospecting has ceased, and mining with it, because of the extortion practiced by the patent owners, who will never undertake to develop the mineral values in their holdings. If these holdings are sold to second persons and put to surface use the result is the same—extortionate tribute must be paid, or the minerals remain locked.

Traveling through the great mineral district of the Sierra Nevadas of California one may learn of valuable discoveries made in mineral lands patented to the Central Pacific Railroad Co., where extortionate prices had been demanded for mountain land that was useful only as grazing land apart from its mineral values, and other instances are on record where permission to buy was refused and extortionate royalties were asked.

This situation was recently put before a representative of the Land Office, who stated that if valuable mineral deposits were later found in a section that had been patented to the land-grant companies, the finder could bring suit attacking the validity of the patent on the ground of fraud or misrepresentation in securing it. But aside from the intolerable expense such a proceeding would impose on the miner, how is it possible to prove or even charge fraud or misrepresentation where surface evidence and the evidence of incomplete prospecting are the accepted tests of Land Office procedure today? The land-grant companies know this and are proceeding serenely with the benevolent assimilation of everything in sight.

Miners and the friends of mining ask only that the minerals reservation be applied, as intended, for the protection of free mining rights in possible mineral lands, and as the matter now stands their only hope is in Congressional action that will prevent all further patents to land-grant companies whose criminal violation of every condition attached to the grants would, in itself, be more than sufficient cause for such action. Beyond this, Congress should discipline the Land Office by necessary legislation, so that its powers would not be used to the detriment of public rights.

Oakland, Calif. C. P. YORE.

Petroleum in the West Indies

THE EDITOR:

Sir—In your article, "Oil Development in the West Indies During 1922," which appears in your issue of March 3, summarized from Mr. Redfield's paper, presented at a meeting of the A.I.M.E. in New York, there is a misstatement, which I should like to correct.

It is there stated that the British Union Oil Co., Ltd., "has the exclusive concession to search for oil" in Barbados. This is not by any means the case. There is no exclusive right given to any company for that purpose. And all concessions have to be obtained from individual landowners, as the government possesses no rights of minerals, and holds no interests in any portion of the lands of the colony, except such small areas as are occupied by government buildings and similar structures. As a matter of fact, the British Union Oil Co., Ltd., does not, I think, today control 50 per cent of the land of the colony; and the remainder is open to any concessionaire or concessionaires who may be interested in oil development in the West Indies.

It is also stated that oil was struck by this company at Turner Hall at a depth of 2,100 ft. This is not correct, and I do not think that the company has yet sunk a well to that depth in that area. The first well sunk by the company there came in at 1,600 ft. or less.

Barbados, W. I. R. H. EMTAGE.

Transportation, Power, and Mining at Bawdwin*

Difficulties in Moving Material Have Limited Operations Seriously —Hydro-electric Power Supplants Steam and Diesel Engines— Timber Supplied by Surrounding Country—Square-Set Method in Use

By R. G. Hall

Late Resident Manager in Burma, Burma Corporation Limited

THE COMMERCE of Burma centers around Rangoon, except for a part of western Burma tributary to Akayab, and part of the extreme southern end. This port is on the Rangoon River, an estuary in the delta of the Irawaddy and connecting with the Irawaddy River. The port is poorly equipped with railway lines and docks, extreme congestion making the handling of goods expensive. The most important traffic out of the port is rice. Another important export is teak. Most of the shiploading is done out in the stream by lighters, and this is true for lead as well as for rice.

The lighters, or "paddy gigs," as the name implies, are built for the rice trade, and consequently care must be used when they are employed for carrying pig lead or other dense material. The use of tugs for moving the barges is unusual; they generally drift back and forth with the tide, assisted by the native handlers with oars or sweeps. Coke or coal from vessels in the stream is unloaded by the ships' winches into boats holding 50 to 100 tons. The loaded boats drift or are helped to the shore and the material is loaded by hand into baskets. It is carried on the heads of Indian coolies, often as far as six or seven hundred feet, and dumped in piles on the ground. Later it is picked up in the same manner and loaded into box cars for further transportation. The coolies are naked as to feet, and most of the body too. Even a native of India will feel pain when his bare foot comes down on a small piece of coke. For the purpose of handling bulk freight, the equipment of the port is barbarous and antiquated, and whatever may have been the conditions years ago, today it has not even the merit of cheapness to commend it.

The railway system of the province is meter gage, fairly well built, and efficiently operated. The ownership is 70 per cent government and 30 per cent private. Operation is by a private company under a closely supervised lease from the government. During the war the meter-gage lines of India and Burma were requisitioned for motive power and rolling stock to meet the needs of Mesopotamia, and the equipment has not been returned. The equipment of the Burma line is thus inadequate for the business of the province, and the country is consequently severely handicapped. Further extension of the lines would be useless until the equipment is adequate for the present business offered. However, further extension under the present system of rigid government control is practically impossible.

The most trying condition of Indian railroading is the all-pervading "graft." Train operation, station forces, shops—everywhere one turns—it is to be found. To the public only that part affecting the train operation and the station agents is important. The conditions of the country—climatic, political, and otherwise—require that the actual work be carried out by natives and Eurasians, reserving for Europeans only the higher executive positions. There are probably native Indians in public and quasi-public service who will not accept a gratuity, but I have not met any. The higher officials have no part in this pernicious system.

The Burma railways connection or junction for the mines is 547 miles from Rangoon. The time for passenger trains is forty-eight hours, and the actual train time is thirty-three hours, as passenger trains do not move at night on the mountain division.

From Nam-Yao, the junction point for the mines, the mining company owns and operates the railroad to the smelter and mines. This is a 2-ft. gage line extending through a precipitous country. Namtu station is 33 miles from the junction; Tiger Camp, the portal of the adit, 7 miles farther, and Bawdwin 6 miles beyond Tiger, making in all a distance of 46 miles from Nam-Yao. All the obstacles usually encountered in railroading, together with a few peculiar to the country and locality, are concentrated along this 46 miles. Curves of 66 to 90-ft. radius vie with grades of 4 to 5½ per cent to make life interesting and sometimes a bit dangerous for the operators.

Modern rolling stock of American type, acquired during recent years, and heavier and better locomotives have made possible the handling of tonnages over this small line which would have been considered impossible not long ago. Unquestionably the greatest handicap the property has had has been a railway line entirely too small and light and inadequately equipped for the work to be done. The files of the company are full of reports of former managers and railway superintendents, as well as consulting engineers, who have protested against the conditions imposed upon them in the matter of transportation. Extensions of mining and reduction plants have been financed, built, and were ready for operation when it was found out that transportation facilities asked for and required in the same connection had been held up and had not been ordered or even considered.

Freight Costs Are High

The cost of carrying a ton of freight over the 33 miles from Nam-Yao to Namtu is Rs. 7 per ton, or, at the normal parity, nearly 7c. per ton-mile; but even this is not as serious as the limitation on tonnage and output imposed by the line and equipment.

Attempt is now being made to get adequate railway connection, but whether this is a genuine effort to improve conditions at the mine, or merely one to improve conditions in the stock market, is somewhat difficult to determine.

The short line from the adit portal and ore bins to the reduction works has more difficult grades and curves than the one previously mentioned. The grades are substantially all in favor of the load, and so do not seriously handicap this line. The chief problem is one of brakes. Some time ago it was decided to electrify this 7 miles of line to transport 1,000 to 1,500 tons of

*The second of four consecutive articles on the Bawdwin mines.

ore daily. A beginning was made by the purchase of heavier rails, transformers, and a few locomotives. These were installed at one end of the line and have been quite successful, but there the matter ends.

Another complication has recently developed. With an increase in the amount of sulphur roasted, the prevailing winds have carried the smoke farther along the hills overlooking the railway. The line is in a deep ravine, and the surrounding hills are extremely precipitous. These hills in the smoke zone are composed of soft-bedded limestone and overlying sandstones, all under heavy coating of residual clay soil. Hitherto this soil has been nailed down in place by a heavy growth of bamboo jungle. The bamboos are now being killed off over an increasing area, and there is nothing to hold the soil on the hills during the torrential rains of June to September. Interruptions are frequent and becoming increasingly a menace to safe operation. This condition was foreseen some years ago, when the placing of the smelting plant in a more favorable location was recommended. The recommendation was adopted, but afterward the work done was abandoned.

From Steam to Hydro-electric Power Development

In the earlier operations of the company the power demand was met by wood fuel for the most part. One steam-driven compressor and one belt-driven compressor were installed at the mine. Air was supplied at the smelting plant by steam-turbine driven turbo blowers; each supplying 25,000 cu.ft. per min., up to 60-oz. pressure. They were in operation until recently. General power demand was met by a 1,000-hp. Diesel, generating 500 to 550 volt, 3 phase, 50 cycle current. This was supplemented later by an additional engine of the same capacity, and power was transmitted to Bawdwin at 11,000 volts. The operation of these two engines was satisfactory both in continuity and economy. The fuel consumption at 75 to 100 per cent load was less than 0.5 lb. per kw.hr.

In January, 1919, I began the construction of a hydro-electric power plant at Mansan Falls, the plans for which were made by an engineering firm that also acted as purchasing agent for the imported materials and machinery. This plant is 28 miles, by the transmission line, from Namtu. The source of power is the Nam-Yao, where it descends over a series of falls within a short distance of each other. The height from flume intake to tailrace, at mean low water, is 276 ft. The upper fall is over a natural travertine dam that forms a basin at the head one-half mile long and up to 20 ft. in depth. The flume takes off from this. Part of the conduit is a ditch, lined with masonry, but most of it is a flume supported on wooden trestles carried on concrete footings. The flume is 9 ft. wide by 5 ft. deep. All woodwork, including trestles, is of teak. This wood is practically everlasting. The bents are four feet apart. The rock of the hillside under the trestles is magnesian limestone, mostly brecciated, soft, and abounding in small caves. Occasional pinnacles of hard rock were encountered, but as often as not these were flanked by rock which would disintegrate under a stream of water. The nature of the surface and the rainfall made it necessary to have foundations on solid rock, and the difficulties in the way were therefore of no mean order. Three thousand feet of flume was built around the side of a hill on ground sloping 30 deg. and in one or two places much more. The grade of the flume is 1 to 1,000. The forebay is a concrete-lined excavation on the hillside above the power house. The forebay spillway had to be provided with a concrete and timber apron to prevent the disintegration of the hillside. The forebay is 273 ft. above the tailrace, and is connected by a steel penstock 7 ft. in diameter tapering to 5 ft. The power house is of brick construction and is well equipped.

The electrical equipment, built in America, consists of three generators (3,300 volts, 3 phase, 50 cycle), with direct-connected exciters. The wheels are horizontal direct-connected turbines. They are of English manufacture. The capacity of each unit is 2,500 kw. at 80 per cent power factor. The wheels have given trouble both in starting and operation, and many changes were necessary to meet the severe conditions which the jungle imposed before continuity of operation was secured.

Steel Towers Used on Transmission Line

The transmission line consists of American-built steel towers, equipped with six 2/0 conductors, and a steel ground wire. The line was built through a dense jungle and over broken and precipitous country. As the high towers offered convenient observation points for monkeys, the fatalities thereto were at first quite high. When self-interest is sufficiently strong a monkey can learn with considerable celerity, and interruptions from that source have about ceased. Large birds, especially vultures, are a frequent cause of interruptions.

The task of patrolling the line, however, was not one to appeal to the nervous. A native patrolman sent in a most pathetic appeal for permission to carry a rifle, stating that he frequently encountered on the path about dusk "a large leopard four by five feet," and wanted to protect himself.

The station current is stepped up to 33,000 volts for transmission, and in substations at Namtu and Bawdwin it is stepped down to 500 volts for power use. Owing to the large amount of induction machinery, much of it underloaded part of the time, the power factor is poor. The only synchronous machine is the direct-connected compressor at Bawdwin, and as this is only 5 per cent of the total load, the correction is small.

The total amount of power available from this plant varies with the season. During the six or seven months, June to December, which include the rains, there is sufficient water to more than supply the full generating capacity. By January this begins to decrease, and by April, in the normal season, there is not much more water than enough for one wheel. From that time until the beginning of the monsoon rains, about 2,000 to 2,500 kw. is all that can be expected.

The construction of the hydro-electric plant was begun in January, 1919, and the first wheel was turned over in July, 1920. As practically no work is possible in jungle locations during the rains, this actually represented twelve months' construction time. The work was carried out principally by one European engineer and his assistant, the rest of the crew being natives. Before the end of 1920 all other sources of power had been discontinued, even as stand-by power, and all plants derived power from the hydro-electric system.

The quantity of timber used underground for stoping purposes is 2 per cent of the weight of ore stoped, 50 cu.ft. being taken as one ton (of timber). For drives, permanent timber and repairs, another 1 per cent is required. A large amount was required for construction purposes during the last four years. This was shipped from sawmills at Mandalay. The quantity of mine timber has been from 3,000 to 4,000 tons yearly,

diminishing as the development underground has decreased. At 600 bd.ft. per ton, this is equivalent to a total cut of 3,000,000 to 4,000,000 bd.ft. annually, including shrinkage in working. A sawmill of a capacity of 7,200 bd.ft. daily has been kept operating on special sizes, lagging, and other timbers.

Exclusive of teak, which is too valuable for local uses, there are six species of trees which can be used for mine timber. All are hard and heavy. Only one is fit to be used in permanent work such as shafts and similar workings. This species, "ingyin," is not immune to decay, but is affected much more slowly than any of the others. The timber growth is sparse. Not more than three or four trees of saw-log size per acre are found. Much of the saw timber has been cut out for some distance back from the railway. Mine logs 8 in. in diameter are still plentiful close to transportation.

The work of felling is done in the dry season, from December to February, inclusive. Lagging is cut up by hand sawing. The cost of felling, sawing, and delivering lagging of 2 by 6 in. by 8 ft. size, along the road or railway is Rs. 35, or $12 per 100 pieces ($15 per 1,000 bd.ft., including all costs except the royalty). The wood is extremely hard, so hard that a bandsaw has not yet been successfully used in any of the Burma mills, and extremely heavy (80 lb. per cu.ft. or over when green). The lagging is carried to the roads on the coolie's back. Mine and saw logs are dragged by buffalo, and for that reason the contractor prefers to do this during the rains. A framing machine is used for the preparation of square-set timbers.

Saw timber for construction purposes is scarce locally, and is now obtained principally from the valley of the Irawaddy above Mandalay. In the larger forests the work is often done by elephants. The logs are transported by bullock or buffalo cart to the Irawaddy and floated to Mandalay. Except the teak, all the timber is heavier than water and requires to be rafted on bamboos. These bamboos are tied to the logs principally by creeper stems. The rafts are most unsubstantial affairs. It is impossible to use any but the larger water-courses for the purpose, as only a little attrition on the rocks of the bottom or side of a stream would be sufficient to cause shipwreck.

Life of Mine Timbers Prolonged by Creosote

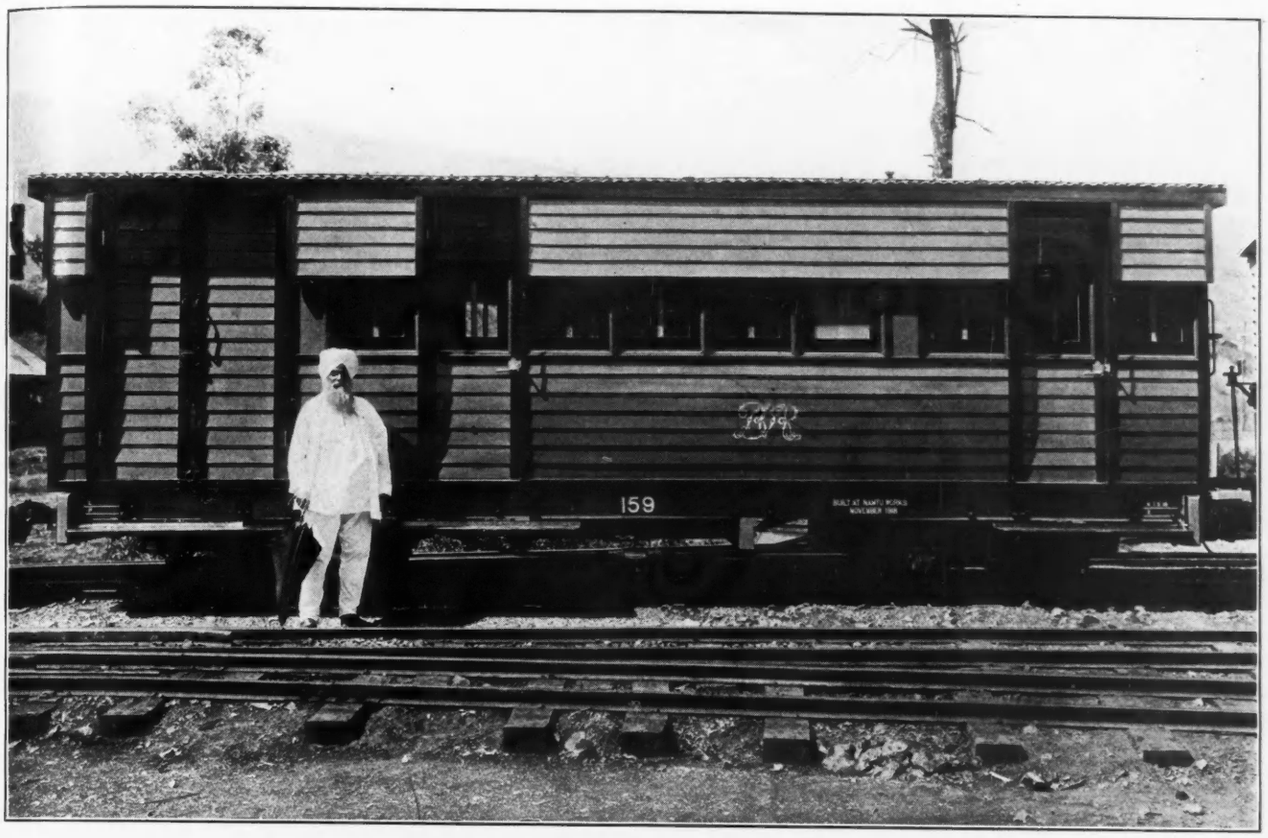
Timber of any kind except teak is short lived in the tropics. One or two species, as "ingyin," in Burma, will resist rot and ants for a reasonable time, but an untreated piece of ordinary timber, left exposed on the ground on in place in the mine, will not last over two or three years. A treatment with creosote is now given for prolonging the life of the permanent timbers underground. The plant has been installed about three years, and the results are promising. The hot and cold tank method is used. In the hardwoods the penetration is slight, only the sapwood of the log being affected, but even that will delay decay, and there is no doubt that the treatment has value. The immunity obtained can be determined only after a few more years.

A detailed geological description of the Bawdwin mines and district has been given by H. M. Loveman, *Trans.* A.I.M.E., Vol. 56, p. 170. But little further exact information concerning the geological features has been gained since the date of Loveman's article. It appears probable that the rhyolite tuff, instead of being dome-shaped, with the axis northwest-southeast, is a sheet-like mass, having both walls approximately parallel and inclined at an angle of approximately 45 deg. The inclination of the footwall of the rhyolite tuff may have an important influence on the size and length of the Chinaman orebody below the Tiger tunnel, or 653-ft. level. At a point on this level, about 1,600 ft. south, the orebody terminates, or is cut off by the Hsenwi fault, and, at approximately the same point, the ore channel in its north-south strike intersects the contact with the underlying sedimentaries, which, as stated, have a strike of approximately northwest-southeast and a dip of 45 deg. The mine has not been explored below the 653-ft. level, but a continuation of the geological structure would be expected to reduce the length of the orebody within the tuff, on the south, by about one foot for each foot in depth. It is to be noted, however, that at this end of the ore channel exact information is not available. The presence of the Hsenwi fault, which at the sixth level is not far from the strike of the underlying sedimentaries but is not coincident with the contact, renders it impossible to say what the exact relation may be between the ore channel in the tuff and its continuation, if any, into the sedimentaries below 653 ft. Exploration designed to elucidate this point is now in progress.

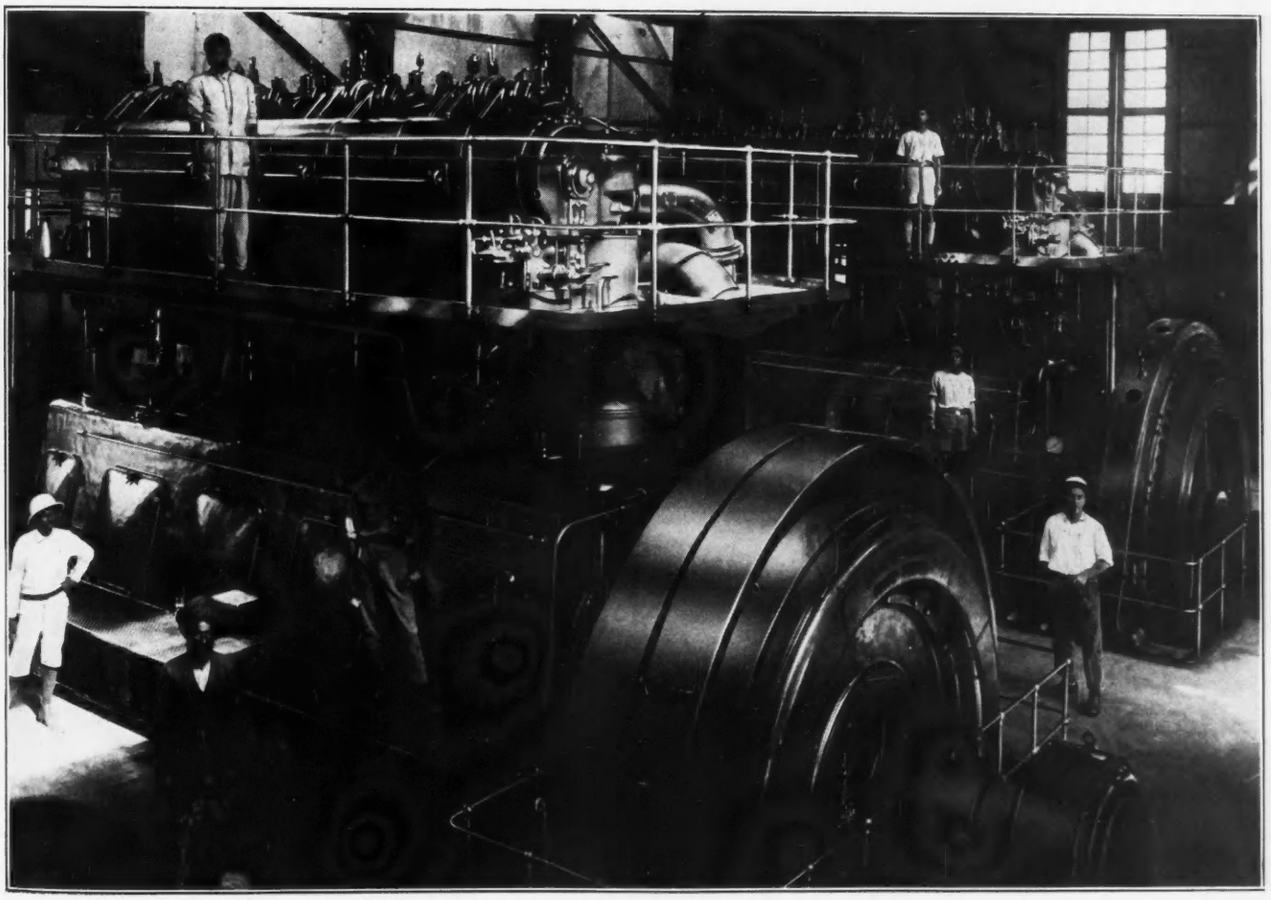
The larger post-mineral faults are, in their present position, lateral displacements. From the size and position of the orebodies on either side of the Hunan fault, the displacement is lateral. Displacement at the Hsenwi is manifestly lateral, but sufficient information is not available to indicate if there has been any large vertical displacement as well. The Shan lode to the north of the Hunan fault is the extension of the Chinaman lode to the south, the dip, strike, area, and mineralization evidence being sufficient on this point. The brecciated zone of the Hsenwi fault is wide where exposed, and the orebody apparently terminates at or near the fault. There is sufficient evidence, however, to conclude that the Hsenwi fault is post-mineral, and that the ore channel on the south has been displaced normally a distance of over 2,000 ft. measured along the line of strike of the fault. Mineralization continues from this point south, and small pockets of ore have been found near the surface, but commercial orebodies have not yet been developed.

The orebody between the Hsenwi fault to the south and the Hunan fault to the north is known as the Chinaman lode. This immense body of silver-lead-zinc ore has now been fully explored above the 653-ft. level and between the two faults, a distance measuring on the strike of the ore channel approximately 1,100 ft. Longitudinally, the orebody is cigar-shaped, the larger end being toward the south. On a vertical cross-section the greatest width is on the fourth level. It narrows rapidly on the sixth. The description given by Loveman is sufficient, as but little additional information has since been obtained. This orebody has been systematically blocked out and prepared for stoping. The blocks are each about 100 by 100 ft. on the plane of the orebody, and sufficient crosscuts have been driven from each level to give complete information respecting tonnage and metal contents.

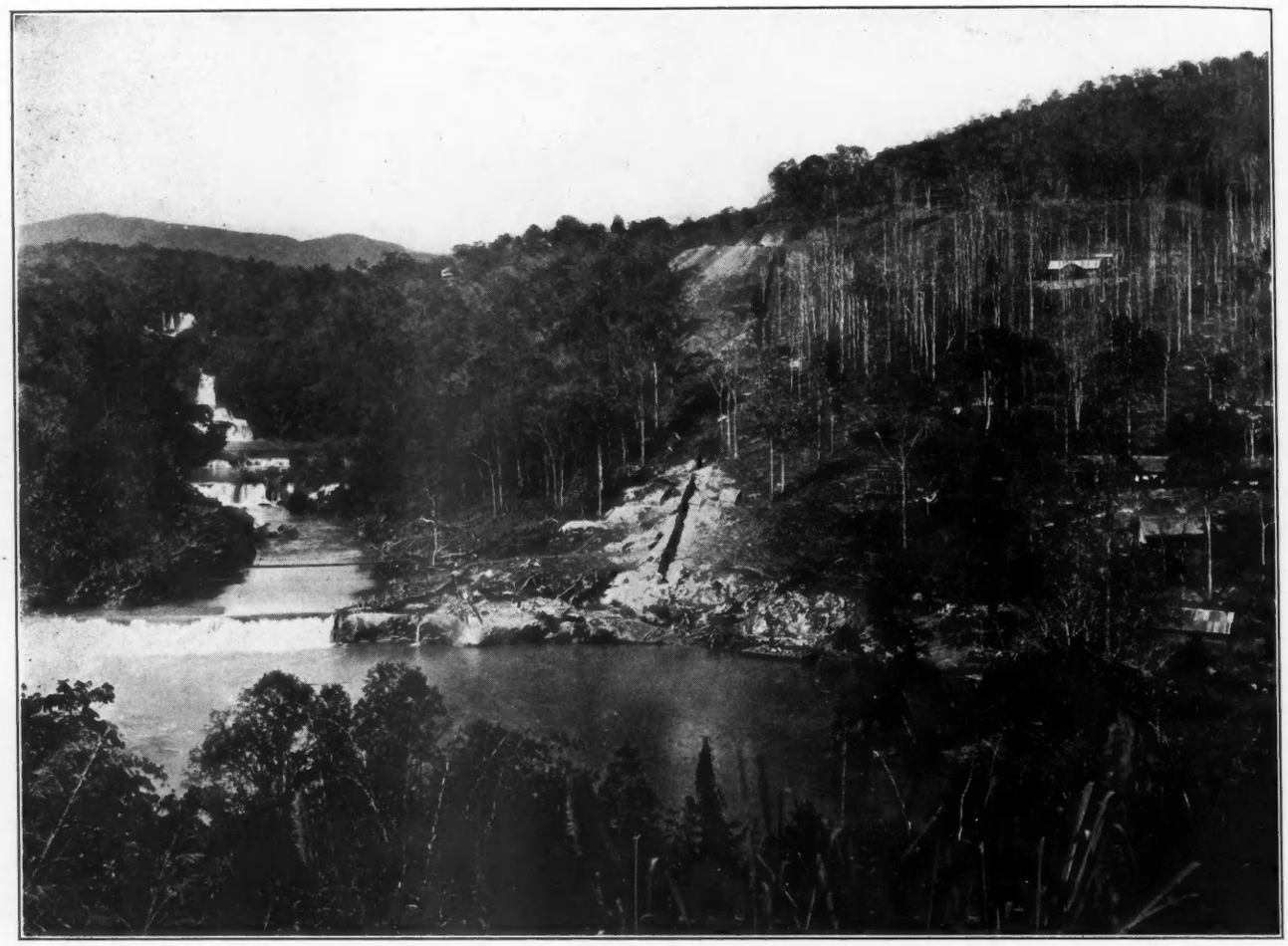
All levels except the fifth have been driven to the north of the Hunan fault to what appears to be the extreme northern limits of the Shan lode, the name given to that portion of the orebody lying north of the Hunan fault. Few or no raises have been driven, and knowledge of that orebody is not yet sufficient for complete calculations of the ore reserves in this part of



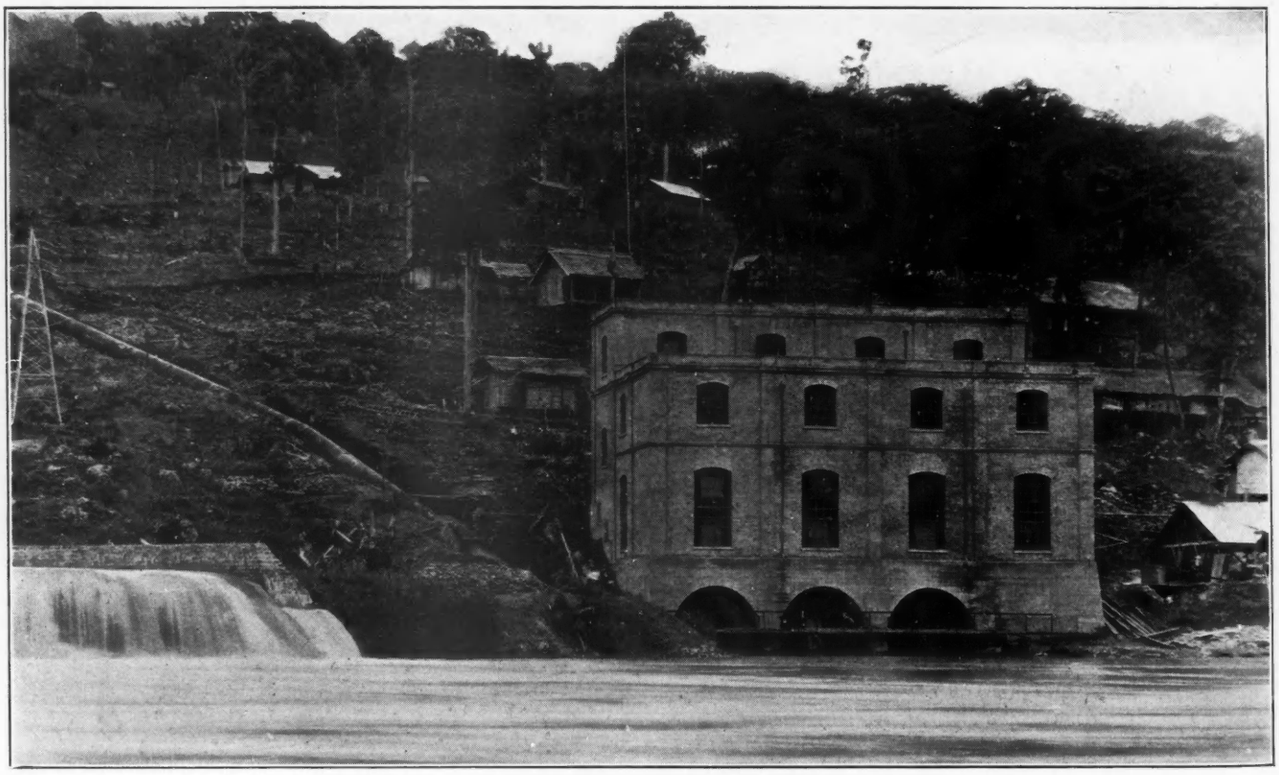
Passenger car built at the mine shops—Sikh foreman of the shops



Diesel-engine power plant, Burma Mines, Limited



Site of the hydro-electric plant, Burma Mines, Limited



The Mansan hydro-electric plant

the mine. However, the uniformity of the deposit in grade and size is so marked that, in this case, probable ore is almost synonymous with proved ore. At the date of this writing, although not at the date of the last report, the whole orebody between 1,800-ft. south and 900-ft. north co-ordinates, and between the surface and the Tiger tunnel, or 653-ft. level, can be considered as blocked out.

The principal orebody (the Shan and Chinaman lodes may be considered as one orebody) occurs in a replacement zone in rhyolite tuff. The strike is substantially north-south, and the dip in the main portion between the first and fifth levels is nearly vertical. Two other lodes, parallel to the main lode, have been developed, and contain commercially valuable deposits. These deposits are small, compared to the principal orebody. Little work has as yet been done upon them.

Size of Orebodies Restricts New Development

To the north of co-ordinate 900 north, which at the 653-ft. level marks the termination of the Shan orebody, the fissure continues as far as development extends, or to about co-ordinate 1,400 north. Mineralization exists over this distance and at one or two points is sufficiently promising to invite further work. The size of the present developed orebodies must necessarily restrict further exploration for the present. Unless unity of policy on the part of the owners should make possible and profitable a program of ore extraction and metallurgical treatment much in excess of anything at this time probable, the developed ore is far in excess of immediate requirements. Under the circumstances, the maintenance of the openings already in existence has become a heavy expense. The present program of about 700 tons per day and a lead output of 45,000 tons yearly may be expected to require a yearly output of 225,000 tons of ore. This would exhaust the developed ore in about twenty years.

Money invested in further development would become a carrying charge against the property to the extent of its interest cost during an unduly long period. Maintenance during all of this period would be a direct charge against the ore being extracted daily from the other parts of the mine. The maintenance charge is now such a serious item as materially to increase the mining cost. Thus the forethought, care, and technical skill of the engineers who in the past have been responsible for the development of the property have been made nugatory by the lack of an aggressive policy. What was a splendid asset of developed ore on which to base a commensurate metallurgical policy has become to some extent a liability requiring daily care and expense in its maintenance and with no hope of realization for many years in the future.

Defining Limiting Ore Value

The ore of the Chinaman lode is essentially a high-grade body of zinc and lead sulphides. The average composition of the orebody does not give much information about the ore itself. It is necessary to define what is "ore" before any comprehensive statement can be made. It was decided, no doubt on the basis of the best advice at that time obtainable, that a total of lead plus zinc equaling 20 per cent should be considered as the dividing line. When this basis was adopted, it was considered that a unit of zinc and a unit of lead in the ore were of almost equal value. As will be shown later, a unit of zinc is of less value than a unit of gangue mineral. However, in general, the ratio of the lead content to the zinc content is about 26 to 18. Each unit of lead is accompanied by approximately one ounce of silver. Consequently, it is still substantially true that 20 per cent combined lead and zinc can be considered "ore." The average composition of the zinc-lead orebody, amounting to over 4,000,000 tons, is 26 per cent lead, 18 per cent zinc, and 23 oz. silver per ton. In addition there is present about 3 per cent iron, as pyrite and chalcopyrite, together with one-half of 1 per cent copper. Small amounts of antimony, arsenic, nickel, and cobalt also occur, in importance in the order named. These constituents, together with the sulphur, amount to 65 per cent or over of the weight of the ore. The influence of this high metallic content on the subsequent metallurgical processes will be discussed later. The orebodies at any one place do not necessarily approach the average closely.

Large orebodies containing 50 to 60 per cent lead were present, but during the operation of the mine the need for financing development and construction from proceeds forced the management to extract the richest ore. Many bands of ore, from high-lead—low-zinc to high-zinc—low-lead, will be found in the same stope. These bands do not at all times maintain their relative positions in the stope. Certain stopes in the property have been supposed to be most valuable for their zinc content. Thus, many thousands of tons of ore containing 35 to 40 per cent zinc, 20 to 25 per cent lead, and 25 to 30 oz. silver per ton have been shipped to European smelting points. At present prices this material hardly paid transportation charges from the mine to the smelter. However, it had already been extracted and shipped to the Rangoon docks when war conditions made further transportation impossible. By the time shipping was available, though metal prices were higher than in pre-war days, the net returns had shrunk almost to the vanishing point.

The ores of the Shan lode are characterized by a lower zinc-lead and a higher copper content. The total proved and probable tonnage in this lode is over 500,000 tons. Of this tonnage 300,000 tons are proved (opened fully) and the remainder is probable ore. The ore classed as copper ore occurs in this lode. The lode will average approximately 7 per cent copper, 16 per cent lead, and 20 oz. silver per ton. By selecting the copper ores, 350,000 tons is obtainable, containing about 11 per cent copper, 13 per cent lead, 8 per cent zinc, and 23 oz. silver per ton. The ratio of lead to zinc in the copper ore does not greatly vary from the average in the Chinaman lode.

No ore is now being mined from the Shan lode, as no metallurgical plant for its treatment is in existence. It is evident that this orebody, although inferior to the Chinaman lode in size, is a valuable asset and well worth future exploitation.

Farther to the north, at co-ordinates 2,200-2,300 north and in a general direction a little east of the strike of the ore channel, there is a copper-bearing gossan of considerable extent. This is completely oxidized and contains from 25 to 35 per cent iron, excess silica, 1 to 1.5 per cent copper, and 5 to 6 oz. silver per ton. It has been followed down to water level, where sulphides are found containing 10 per cent copper and from 5 to 7 oz. silver per ton. Systematic exploration or geological work has not been done on this prospect.

The magnitude of the orebody, together with the cost of power for pumping and hoisting, justified the

opening of an adit. The Tiger tunnel was driven from the Sterne River at a point on the railway five miles distant from Bawdwin. The adit intersects the south end of the orebody at 7,600 ft. from the portal, and at a depth of 653 ft. below the collar of the working shaft. It is about 12 by 14 ft. in section and is equipped with two 2-ft. gage tracks for electrical haulage. Mule haulage was supplanted by electrical operation in 1919. Baldwin-Westinghouse locomotives, 250 volts, d. c., are used, each handling ten four-ton cars, or forty tons net per train. The tipple at the portal is double tracked and has two circular cradles each capable of handling four cars at a time. The tipple, cradles, and conveying system are electrically operated and handle 100 tons per hour. The ore passes from the tipple bins through automatic-drum feeders to a conveying belt, which elevates it to the top of the loading bins. The bins have a storage capacity of about 3,000[1] tons. The system is arranged to permit of several grades of ore being mined, stored, and shipped separately. The surface equipment was designed and installed by W. R. Dagenhardt, then chief engineer, and reflects the greatest care in design and construction.

The compressor plant at Bawdwin consists of an Ingersoll-Rand, 2,300-cu.ft. compressor direct-connected to a synchronous motor (500 volts, 3 phase, 50 cycle), a belted Ingersoll-Rand 950-cu.ft. compressor, and one Robey cross-compound Corliss steam-driven compressor (1,100 cu.ft.). Almost all the drilling is done with Jackhamers, Ingersoll-Rand type, as it is difficult to teach the art of hand drilling to the natives. The small one-man hand machine is suitable for the use of two miners of the kind that is commonly found at Bawdwin.

Square-Set Rill System

Mining is by the square-set rill system, which was adapted from American practice and applied to local conditions by A. B. Colquhoun, mine manager. Several conditions prevailing at Bawdwin have combined to make this necessary. The ore is valuable. The system adopted must therefore permit the extraction of the whole of the orebody. Economic conditions and conditions at the metallurgical plant do not permit the extraction of all the ore in a stope at any one time. Selective mining is necessary. The system permits of the mining of a vertical slice as narrow as one set without interference with the slices on either side. The great weight of the ore, its friable nature, and the width of the orebody prevent the opening of a wide back at any time and restrict mining to a width of three sets or less.

The backfill consists of the gossan and vein matter from the outcrop and from the contiguous surface. It breaks fine, and, being argillaceous, has good cohesive properties. After the fill has been in the stope a short time and has been thoroughly wet, the adjoining sets may be stoped and the lagging removed without the fill caving to any extent. By the system now in use eventually all the backfill will pass from the surface through passes into the stopes with only occasional handling. Lagging along the wall consists of bamboo poles 3 to 6 in. in diameter and up to 20 ft. long. These are obtainable from the near-by hills and are cheap and light in weight.

Timber is framed by machine on the surface at the adit level and is hoisted through an inside two-compartment double-cage shaft equipped with electric hoist. Employees for the most part live at Bawdwin, which is at the upper level, and are handled by the same inside shaft to and from their work. A two-compartment single-cage winze between the second and the sixth level is available as well.

[1]Tons used throughout refer to the British system, 2,240 lb. to the ton.

Increase of Underground Temperatures Necessitates Induced Ventilation

Mine ventilation was a minor consideration in the earlier development. The extension of development and the opening of more and larger stopes made natural ventilation inadequate during the rainy season, June to September. Ordinarily, during the cold, dry winter season, sufficient air enters through the adit, and down the shaft to the stopes and raises, escaping through the many openings along the vein. Oxidation of the sulphides is at all times vigorous, and, although there are no gases such as sulphur dioxide, the temperature of the ore in place or broken in the stopes will frequently become so high as to be unbearable to the hand. The installation of a small fan near the surface exhausting 35,000 cu.ft. per minute from the worst part of the mine afforded a partial remedy for the high temperatures in the stopes. To get the greatest efficiency from the miners underground will require a volume of air approximating 150,000 cu.ft. per minute to be drawn through the mine workings during the wet season.

Russian Gold-Mining Industry Somewhat Improved

From *Economic Life* (Moscow, Russia), abstracted in *Commerce Reports*

A report on the gold-mining industry in the Far Eastern Republic was submitted in the session of the executive committee of the Council of National Economy at Moscow by the chief of the Far Eastern Mining Bureau. Prior to the war the gold-mining industry yielded not less than 2,000 poods of gold per annum [1 pood = 36.11 avoirdupois pounds]. The mining locations were badly disorganized and destroyed later. During 1921 and 1922, by special legislative and administrative measures, the industry was resuscitated to some extent. For eight months of 1922 the registered extraction of gold amounted to 165 poods, so that the total yield may safely be taken at 300 poods. Production during 1923 is calculated in the report at no less than 600 poods.

All the gold fields in the Far Eastern Republic constitute the property of the state, both state-controlled extraction and leasing and concessions systems being in operation. Two foreign concessions are at present operating in the Far East—one American and one English.

Newspaper Man Discovers the Ultimate in Cold

According to the New York *Sun*, "the coldest temperature in the world is in the three immense helium tanks outside the laboratory in the Interior Department Building in Washington, D. C. The temperature inside the tanks is 515 degrees Fahrenheit below zero." As the absolute zero has been calculated to be 459.2 degrees below zero, no doubt scientists will be much interested in this statement.

The Metallurgy and Economics of the Hollinger and of the New Modderfontein

Technical Histories of the Companies—Comparison of the Two Types of Ore—Metallurgic Results—Costs —Labor Requirements

BY A. W. ALLEN
Assistant Editor

THE HOLLINGER gold mine, in Canada, is many thousands of miles distant from the New Modderfontein gold mine, in Africa, and is operating under entirely different conditions. A superficial examination of the available technical data of the two properties shows, however, many interesting points of comparison.

The early metallurgic history of the Hollinger has been described in detail by P. A. Robbins.[1] The earliest process used—about 1910—was amalgamation, apparently; one 10-ft. plate recovered about 60 per cent of the gold in a high-grade ore. Then a thirty-stamp mill was erected, with plates and concentrating tables, to which it was decided to add a cyanide plant should this be justified by later tests and results. These plans, however, were abandoned after a disastrous fire had destroyed the mill. The ore was then re-tested, whereupon amalgamation showed a poor recovery, although a combined cyanidation-concentration treatment gave encouraging results. A new mill was designed and erected, embodying concentration, amalgamation, cyanidation. Gravity concentration, it is interesting to note, was adopted "for the sole purpose of removing from the pulp the comparatively coarse particles of gold which would require a long time to dissolve in the cyanide solution used."[2] Trent agitators were recommended and erected; later, these were replaced by Dorr machines. Moore vacuum filters were adopted to separate the valueless gangue from the aurocyanide solution.

The concentrate was fed by hand into grinding pans, but after two weeks of operation it was found that no amalgamation had occurred, so the process was discarded, the pans being used as agitators.

DETAILS OF HOLLINGER PRACTICE

Filter-press clarification of solution was tried and discarded in favor of vacuum filtration. The stamps and tube mills were augmented from time to time and a ball mill was added. Counter-current decantation was afterward favored, and a plant was erected. The most recent innovation is the impoverishment of decantation-plant tailing by means of Oliver vacuum filters. Hollinger practice now consists of:

1. Primary crushing by gyratories and rolls.
2. Stamp milling and ball milling in cyanide solution.
3. Tube milling in closed circuit with Dorr classifiers.
4. Vacuum filtration (Moore) of thickened classifier overflow.
5. Concentration of pulp on Deister concentrating tables.
6. Regrinding of concentrate in tube mills.
7. Agitation and counter-current decantation of most of the slimed ore after thickening.
8. Vacuum clarification of solution.
9. Vacuum filtration of counter-current decantation tailing.

Hollinger ore is, from all accounts, exceedingly soft and easily ground; two-thirds is said to be schist, the remainder quartz. Mechanical troubles invariably result when such a material is slimed and when the fine sand is separated or allowed to separate itself from the more flocculent proportion. The gold occurs as coarse and fine particles. The ore treated, chemically speaking, is clean; it contains no rebellious elements other than a small percentage of pyrite.

TREND OF METALLURGICAL PRACTICE AT THE NEW MODDERFONTEIN

The New Modderfontein, on the other hand, began with amalgamation thirty years ago, and has retained this process as the fundamental method for the recovery of the bulk of the gold in the ore. Milling was started in 1892, with ten stamps; between October, 1893, and March, 1894, twenty stamps were dropping. A sixty-stamp mill and cyanide plant began operations in May, 1896. The ore was milled in water and amalgamated; the impoverished tailing was divided into sand and slime, the former being leached by gravity percolation, the latter being treated by settlement and decantation. Since then no change has been made in fundamental practice, which now consists of:

1. Primary crushing in gyratories.
2. Stamp milling.
3. Tube milling in closed circuit with conical classifiers.
4. Amalgamation.
5. Leaching of sand.
6. Agitation and vacuum filtration of slime, after thickening.

It is interesting to note that, over a period of thirty years, the principal changes in metallurgic methods have been in an endeavor to modify rather than to discard early practice. These include:

1. Adoption of the heavy, single-mortar Nissen stamp in place of the five-stamp mill of Californian pattern.
2. Devolution of some of the work of crushing, from stamps to tube mills.
3. Isolation of the amalgamation plates in a separate section of the mill.
4. Continuous instead of intermittent thickening of slime.
5. Collection and treatment of sand in one vat.
6. Adoption of mechanical agitation and vacuum treatment of slime in place of natural settlement and decantation.

The introduction of sundry new features into the arrangement of the new mill in 1914 was due to F. L. Bosqui, who at that time was consulting metallurgist to the Rand Mines, Ltd. No discard of fundamental practice was recommended. Even the stamp mill was

[1] *Engineering and Mining Journal-Press*, June 24, 1922.
[2] H. A. Megraw, *Engineering and Mining Journal*, Dec. 21, 1912.

retained, although a new and improved type was adopted, after its successful use at the Modder B. Amalgamation was considered a desirable and efficient means of impoverishing the ore before cyanide treatment was commenced, but the plates were isolated and placed under better control, following recent practice at other plants. Sand leaching in large unitary charges was considered economical, but the collection and treatment of the material in one vat—the avoidance of double treatment—was suggested by Mr. Bosqui and adopted as a practicable and desirable simplification. Slime thickening by means of Dorr thickeners was continuous instead of intermittent. The Butters vacuum filter, especially suitable for large-scale operation, displaced the decantation plant.

The New Modderfontein is one of the mines of the Far East Rand, where the ores are becoming more refractory. The hardness of the ore milled is above the average of gold ores—a feature that has its compensations, for a suitable grinding medium can be segregated during primary crushing and used in the tube mills in place of imported or manufactured pebbles. The ore is of the usual Rand type of conglomerate, known as banket. Pebbles of quartz or chert are incased in quartzite matrix. Pyrite occurs in amount varying from 2 to 5 per cent. The gold is finely disseminated and distributed throughout, being associated especially with the pyrite.

Grade of Ore Treated and in Reserve

Unfortunately, the New Modderfontein company is one of the few whose fiscal year ends on June 30. The comparison, therefore, must be made between the year 1921 at the Hollinger and the twelve months ended June 30, 1921, at the New Modderfontein. This difference is of little significance, however; although, on account of the general decline in commodity prices, the financial reports of the Hollinger will show to greater advantage. The strike on the Rand early last year precludes the possibility of comparing results obtained during 1922.

The Hollinger and the New Modderfontein are two of the greatest gold mines in the world, a fact that is evidenced by statistics of reserves. This phase of the subject may be considered irrelevant to the discussion, but it must be admitted that income and profits should be considered before determining outlay for plant and equipment. The ore reserves at the New Modderfontein on June 30, 1921, amounted to 8,884,600 tons, containing 8.4 dwt. ($8.68) per ton. Gold is and for many years has been worth $20.67 per ounce. All the South African data are given in pennyweights per ton, which will be expressed in this comparison in terms of the American dollar. The reserves at the Hollinger, following American custom, are given in terms of dollars only; on Dec. 31, 1921, they amounted to 4,392,917 tons, averaging $9.72 per ton.

A summary of technical results, compiled from official information, is as follows:

Metallurgic Results, New Modderfontein and Hollinger

	New Modderfontein, Twelve Months Ended June 30, 1921	Hollinger, Year Ended Dec. 31, 1921
Tons milled	1,083,000	1,072,493
Grade, per ton	$10.29	$9.67
Tailing, cents per ton	30.3	31
Recovery by amalgamation, per cent	64.5	.....
Recovery by cyanidation, per cent	33.3	96.7
Total actual recovery, per cent	97.8	96.7

Considering the difference in the methods of treatment, the metallurgic results are remarkably alike. No figures are given in the Hollinger report to show the relative amounts of gold and silver in the ore or the respective extraction and recoveries of the two metals. An error in comparison may be due to this omission, for the percentage extraction, using this method, will vary according to the price of silver. It is generally understood, however, that the Hollinger is essentially a gold mine. Silver on the Witwatersrand does not occur in economic quantity, and no metallurgic account is kept of the amount recovered.

Costs in Close Agreement

To permit a rough comparison of costs, the pound sterling has been assumed to be equal to $3.70 during the period from July, 1920, to June, 1921, inclusive. It would be illogical, of course, to compare mining and milling costs on the two properties without taking into consideration the widely different conditions that prevail. The totals are so nearly alike, however, that they are given herewith.

Mining and Milling Costs per Ton Milled

Labor	New Modderfontein	Hollinger
Kafir	$0.65	.....
White	1.31	$2.52
Stores	1.37	2.24
Sundries	1.00	0.11
Total	$4.33	$4.87

"Sundries" in the Hollinger account comprise insurance, marketing bullion, and workmen's compensation. The New Modderfontein "sundries" account, nearly ten times as great as the one at the Hollinger, includes the usual heavy assessment in regard to miner's phthisis, and head and London office expenses.

A general financial comparison is impracticable, because of lack of data. The accounts of South African companies appear to show no allowance for depreciation of plant and machinery. Many of them have been in operation for a great number of years; and as no radical changes have been made in metallurgic treatment since cyanidation was introduced, the allowances would be comparatively small in any event.

The following figures emphasize the excessive rate of taxation in South Africa as compared with taxes in Canada; it is more than double. The higher dividends paid by the New Modderfontein are due partly to the estimated long life of the mine. Shareholders of the Hollinger are reminded "that every dividend paid represents a certain amount of capital and should be so treated. It makes no difference," continues President Timmins, in the annual report for 1921, "whether payments to shareholders in a mining company are made as dividends or as return of capital, because every such payment diminishes to that extent the capital value of the property from which the ore is taken to provide the dividend or capital return." This subject is an interesting one and might well be discussed more extensively.

General Financial Comparison

	New Modderfontein Twelve Months Ended June 30, 1921	Hollinger, Year Ended Dec. 31, 1921
Revenue from sale of bullion	$10,986,032	$10,031,050
From sundry sources	.....	283,465
Total	$10,986,032	$10,314,515
Working costs	4,699,540	5,222,855
Operating profit	6,286,492	5,091,659
Depreciation allowance	.....	627,488
Taxes	1,102,415	429,889
Dividends	5,180,000	3,198,000

Comparison of Labor Requirements

The labor force at the two properties during the periods under review was as follows:

	White	Kafir	Total
New Modderfontein	733	5,390	6,123
Hollinger	1,582	.....	1,582

From this it would seem that 849 white men at the Hollinger do approximately as much work as 5,390 Kafirs at the New Modderfontein. The average wage of white men was as follows: New Modderfontein, $161 per month; Hollinger, $143 per month. From personal experience I believe that the dearest commodity in South Africa is the "cheap" native labor. The utilization of races of low mentality and poor physique impedes progress and hinders the introduction of labor-saving devices. It introduces, furthermore, an undesirable complication in the industrial relations between employer and white employee.

Sulphur-Dioxide Leaching of Copper Ores as Viewed by an Australian

FOR SOME TIME the Southwest Experiment Station of the U. S. Bureau of Mines has been carrying on experimental work in the leaching of copper ores by sulphur dioxide, and a report was recently issued by C. E. van Barneveld and E. S. Leaver. This report received considerable publicity, and comments on the work done were made in an editorial in the *Engineeering and Mining Journal-Press* of June 24. It was also republished in the August issue of the *Chemical Engineering and Mining Review,* and led an Australian follower of the process to write the following letter to that journal, which was published in the September number:

"The production of copper-sulphate solutions by the leaching of oxidized copper ores with sulphur-dioxide gas dissolved in water was first taken up in this country by Mr. Peachey, about ten years ago, and by myself in 1916. In each case the copper was recovered from the solutions by deposition on metallic iron.

"Mr. Peachey caused the spent solutions which left his cementation tanks to percolate through a dump of partly treated ore. This caused the deposition of excess iron from the solutions as oxide of iron on the dump, together with the formation of a certain amount of ferric sulphate in solution, and also the dissolving of a small amount of copper from the dump by the ferric sulphate formed. The solution was then treated with sulphur-dioxide gas, whereby the ferric-sulphate contents was converted to free sulphuric acid and ferrous sulphate. This solution was then used to leach fresh oxidized ore.

"I myself have not found any necessity for a dump of ore in the circuit, nor do I find that the commercial sulphur dioxide used is able to reduce all iron present in the solutions to free acid and ferrous sulphate (see my article on 'The Hydrometallurgy of Copper,' *Chemical Engineering and Mining Review* of April 5, 1922).

Manipulation Highly Important

"The production of ferric iron and sulphuric acid depends entirely upon the manipulation of the process, and, in my process, may be altered at will, within certain limits. I have found no difficulty in getting a complete extraction of copper from copper-carbonate slimes, and furthermore, I can float any sulphides occurring in the slimes at the same time as I am leaching the carbonates. I do not find it necessary to eliminate the sulphur dioxide from the flotation pulp before attempting flotation; in fact, the harder I turn on the sulphur dioxide during flotation the quicker and cleaner the float. If the supply of sulphur dioxide be stopped, the float also stops immediately. The flotation concentrates obtained in this manner are the cleanest I have ever seen. In the case of Mount Hope slime, carrying 1½ per cent copper as carbonate and 1½ per cent copper as chalcopyrite, experiments carried out on 100 lb. samples gave a complete extraction of the carbonate copper and left from 0.15 per cent to 0.20 per cent copper as sulphide in the tailings. The concentrates never carried less than 28 per cent copper, and in one test (probably due to the presence of some copper glance) they reached 38 per cent copper.

"On page 364 of your Aug. 5 issue it is stated in paragraph 6 of 'The requirements for good operating conditions,' that the pulp issuing from the drum must be aërated to oxidize any sulphites and to remove any remaining sulphur-dioxide gas, as this is necessary for the recovery of dissolved copper by precipitation on iron and flotation of cement copper. I have no hesitation in saying that the presence of sulphur dioxide has no detrimental effect on the precipitation of copper by metallic iron; in fact, its effect is beneficial where the process is not cyclic, as in the case cited by Messrs. C. E. van Barneveld and E. S. Leaver.

Flotation of Cement Copper

"On the same page, under the heading, 'Four methods of recovering copper from sulphate solutions are available.' No. 3 method is given as precipitation on sponge iron in the pulp, the cement copper to be recovered by flotation. By adding metallic iron to the pulp during the leaching step metallic copper may be precipitated, but some copper sulphide is also thrown down, for the action of sulphur dioxide and metallic iron in the presence of water produces a certain quantity of sulphureted hydrogen. We are told in our chemistry books that if sulphur dioxide and hydrogen sulphide gases are brought together metallic sulphur will be precipitated, but my own experience in a working plant is that this reaction does not take place to any extent, if at all, the probable reason being the great dilution of the gases. It is quite possible that the precipitated metallic copper could also be coated with a sulphide film by this means, thus giving the necessary condition for its flotation. I have not tried to float copper precipitate in this manner, but I believe it might be done on a commercial scale.

"We already know, from American published work on the subject, that if copper-sulphate solutions of a certain degree of concentration and saturated with sulphur-dioxide gas be heated while under a pressure of 30 lb. per sq.in., about half their copper contents will be precipitated as metallic copper, with a simultaneous regeneration of twice the amount of free sulphuric acid which would be liberated by the deposition of the same quantity of copper by electrolysis with an insoluble anode.

"As only half the copper can be deposited, a cyclic process would be necessary, as it is with electrolytic deposition. The accumulated impurities in these cyclic leaching solutions would need to be kept down to a safe limit, as is also found necessary when electrolytic deposition is used. The purification of the electrolyte is a knotty problem, but there is a way out, I am convinced, for those who would persevere. For instance, it is claimed that it is possible to precipitate sulphate of iron from solutions under certain conditions of pressure.

"It seems to me that, according to published statements, this sulphur-dioxide leaching and flotation process has reached far closer to bedrock in Australia than it has yet done in America, and I am confident that had I the opportunity of carrying out large-scale experiments I could go still further than I have yet gone. There is an immense scope for this process not only with oxidized ores or mixed oxide and sulphide slimes, but also with roasted sulphide ores.

"The pioneers of this process in Australia have been poor men, not possessed with the persuasive powers of a master politician, and so, although its possiblities have been placed before the chief copper-mining companies of Australia, they have fallen on deaf ears. Now, however, that our American friends have taken it up, doubtless more will be heard of it in Australia in the near future.

"B. Du Faur.

"Turramurra, Sydney."

We believe there has been no disposition in America to belittle the efforts of Australian metallurgists in the development of this process, even though it has never received commercial application as a result of their work.

Rock Drill Steel

The Various Types of Bits and Shanks in General Use, With the Reasons for Their Design and Remarks Upon Proper Heat Treatment and Care

By Royal J. Day
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THE FIRST REQUISITE for drilling rock and ores is a properly working rock drill, operated by either compressed air or steam. To obtain satisfactory results with these machines we must have an adequate supply of drill steel. The drill steel consists of three parts—namely, the shank, body of the steel, and the bit.

The stank of the steel is that portion which fits into the chuck of the rock drill. It must be properly formed and heat treated to give satisfactory results. The body of the steel is the portion that governs its length, and consists of a straight piece of steel (either hollow or solid and of the desired sectional shape), the shank being formed on one end and the bit on the other. The bit is the portion of the steel that comes in direct contact with the rock, and upon the proper design and heat treatment of this part depends, to a great extent, the speed at which holes are drilled.

It is with the shank and bit of the drill steel that we are most interested, and the purpose of this article is to describe the shanks and bits in general use.

Before the development of the hammer type of drill, only solid steel was used for rock-drilling purposes. The introduction of the hammer drill, with the feature of a stream of water passing through the steel to the bit, made necessary the making of what is known as hollow steel—that is, steel having a small hole running the entire length to permit the passage of water. This steel is generally made in round and hexagonal sections. Other sections of steel used are octagon and the various styles of cruciform, which are solid steels. The hexagon steel is also obtainable in the solid, as well as light sections of twisted cruciform and twisted concave. The two latter steels are used to give an auger effect for the removal of the cuttings when drilling soft material.

Because of the severe treatment to which drill steel is subjected, it should be made of the best material obtainable. The carbon content of the steel used must be such that the steel can be hardened properly, but should not be so high that the steel is brittle. The steel should be made from selected iron, as pure as it is possible to obtain; the content of phosphorus and sulphur should be kept at the lowest possible limit. It is necessary to have a certain amount of manganese present to insure the proper forging of the steel; otherwise it would be liable to crack or break.

The analyses of different grades of steel made for rock-drilling purposes may show variations from the following; they should, however, be within reasonable limits:

Chemical Composition of Rock Drill Steel

	Per Cent
Carbon	0.85 to 0.90
Manganese	0.30 to 0.40
Silicon	0.10 to 0.20
Phosphorus, not over	0.03
Sulphur, not over	0.03

To obtain the best results from heat treatment it is necessary that the forging of the bit and shank should be done at the proper temperature. This temperature is claimed to be 1,550 deg. F., and should not exceed 1,600 deg. F. Care should be used, so that no forging is done with the temperature of the steel at too low a point; if necessary, reheat the steel and forge properly. If this rule is followed one will be repaid by the better quality of the drill steel, which will easily make up for the additional time expended.

The Friction of the Shank and Bit

If the drill steel is to work satisfactorily, care must be exercised in regard to the heat treatment and tempering of both shank and bit. The shank end of the steel used with hammer drills must be hardened to such an extent that it will not be upset or deformed by the action of the hammer striking against the end of the steel, and should not be so hard that small pieces will be broken off, thereby making it necessary for the piston of the drill to strike against a rough surface. The bit of the steel should be hard enough to stand up under the strain of being driven against the rock for a reasonable length of time without showing wear to such an extent that the steel is unusable, but should not be so hard that it will be readily broken by the impact upon the rock.

The critical temperature of drill steel is about 1,375 deg. F.—that is, it is impossible to harden the steel below this temperature. It should be remembered that a certain amount of heat is lost in transferring the steel from the heating furnace to the quenching tank; therefore, it is necessary to heat the steel above this temperature to receive proper results.

The recommended temperature for tempering the bits is 1,450 deg to 1,500 deg. F. When the steel has reached this temperature, it should be removed from the fire and plunged vertically in the water, care being taken to see that the cooling of the steel takes place a uniform distance back from the cutting edge of all of the wings of the bit. It may be advisable to place a screen the required distance below the surface of the water, to insure all of the steels being submerged to the same depth, thereby assisting in obtaining uniform results.

After the steel has become cold it should be properly tempered. Owing to the fact that nearly every field of work presents a different problem in regard to the proper hardness of the drill bit, it is impossible to specify a temper that could be used with any degree of satisfaction for all of the various grades of rock that are encountered. This point must be settled in the field, and it may be necessary to make a considerable number of experiments before the proper degree of hardness is determined.

It may be advisable to install an automatic quenching tank. These tanks are obtainable in the revolving type, whereby the steel is gradually submerged to the required depth and then gradually emerged, the depth of submersion being adjustable to meet the various re-

quirements. Quenching tanks of this type are of great assistance in maintaining uniformity of temper in the finished steel.

After the shank is properly formed it must be given the right heat treatment to assure its standing up under the severe strain placed upon it. First let the steel become cold after forging, them reheat to 1,450 deg. to 1,500 deg. F., and plunge in oil, submerging in a vertical position to a depth a short distance past the driving lugs; allow the steel to become cold, them draw the temper to about 600 deg. F. Because of variations in the composition of the steel used, it may be necessary to vary the heat treatment from what is specified above.

Good results are obtained if the steel is annealed before hardening. Heat the steel to 1,550 deg. F., cover with powdered lime, and allow it to cool slowly.

The quenching bath should be kept cool and as near a uniform temperature as possible. If running water is not available, so that the tank can be provided with an inlet and outlet pipe and the water kept cool by this means, it will be necessary to provide the tank with a device whereby the water can be agitated or kept in motion, thereby preventing its heating too rapidly.

Considering first the shanks of the drill steel. Those in most general use are shown in Fig. 1. At *A* is shown one of the shanks used with the piston-type rock drill. The piston of these machines reciprocates, and it is necessary to clamp the drill steel rigidly in the chuck which is attached to the piston rod of the drill. These chucks are provided with renewable bushings, and the drill steel is swaged to the required diameter (*X*) and length (*Y*) that may be required for proper fit. In the early type of piston drills this form of shank was used exclusively, but the chucks of the drills of recent manufacture are provided with a bushing whereby either round or octagonal section shanks can be used. These bushings are generally designed so that more than one size of steel will fit, thereby not confining the operator to such narrow margins in the selection of steel as when the chuck is made to take one size of shank only. The octagonal section steel is generally used with piston drills, and when used with the type of bushing referred to, it is not necessary to form a shank on it. However, when using drill steel on which no shank is formed, care should be taken to see that the end of the steel is square.

Design of Shanks for Various Types of Drills

The construction of the hammer type of rock drill calls for a shank of different design than that used with the piston drill. As is well known, the piston of the hammer drill delivers the blow directly upon the end of the drill steel (or on an anvil block if an anvil type of chuck is being used), and if the steel were rigidly held in the chuck it would only result in a waste of effort. To obtain satisfactory operation it was necessary to design a chuck wherein the steel could be held in the proper position to receive the blow from the piston and at the same time have a limited forward and backward movement. It was also necessary to provide means whereby the steel could be rotated. This led to the development of the shank shown at *B*, Fig. 1, which is the form of shank adopted for practically all of the mounted hammer drills. It will be noted that two driving lugs are formed which engage with proper drivers in the chuck; this provides facilities for rotating the steel. Four important points in the construction of this shank should be noted: (1) The shank must be of proper diameter to fit properly in the chuck; (2) the driving lugs on the steel must be the right distance from the end of the steel, to permit the steel entering the drill a proper distance to assure satisfactory working of the machine; (3) the end of the shank must be squared so as to provide a good surface to receive the blow of the piston; and (4) the hole in the shank must be centrally located and of required size. If not, trouble with the water tube of the machine may be the result.

The dimensions shown are for the 1¼-in. diameter

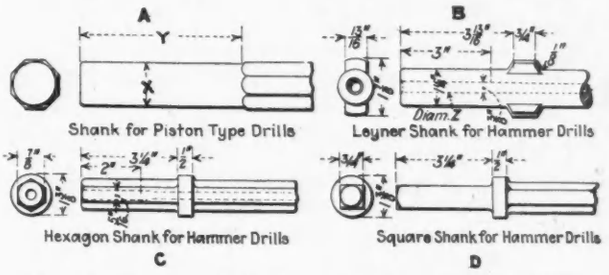


Fig. 1—Types of shanks used in machine drills

shank. This shank is also used in the 1⅛, 1⅜, and in a few cases in the 1-in. sizes. The dimensions shown are standard for all sizes of shanks, with the exception of the outside diameter and thickness of the driving lugs, which varies according to the diameter of the shank.

When this shank is used with drills of the water type it is important that necessary attention is paid to the hole in the steel. If not properly located in the center, and of the required size, considerable trouble will be experienced with the water tube of the machine, due to interference.

Figure 1 *C* shows the type of shank that has been adopted for use with the smaller sizes of hammer drills, and is used with practically all of the light-weight drills made to be operated unmounted. As shown, this shank is ⅞ hexagon 3¼ in. long, having a collar 1⅜ in. diameter by ½ in. thick. This collar prevents the steel from entering too far into the drill. The dimensions shown are for making the standard-size shank. This form of shank is also made in a larger size, being 1 in. hexagon 4¼ in. long for use with drills requiring a steel heavier than the ⅞ section, and the size of the collar varies proportionally.

With further reference to Fig. 1, at *D* is shown a modification of the shank shown at *C*. This shank is used with drills of the same class using the shank shown at *C*. The standard size for shank shown is ¾ in. square —3¼ in. long with a 1⅜ in. diameter collar ½ in. thick.

This type of shank is seldom if ever used in this country, but is made up to satisfy the demands in Europe, where this shank, formed on round steel, is recognized as standard. It is, however, troublesome to make, and its use should be discouraged.

The bit of the drill steel is the most important part, but until the introduction of the power drill sharpener, little attention was paid to the proper design, this important work being left entirely to the judgment of the blacksmith. Naturally, he would make the form of bit that stood up the longest, regardless of the amount of drilling accomplished. Considerable trouble was experienced by improperly formed bits—that is, the wings were not all the same length, or proper clearance was

not provided, and numerous other points were neglected, so that there was generally more or less dissatisfaction with the drill steel. The development of the power drill sharpener changed these conditions considerably. By the use of this machine it is now possible for the blacksmith to sharpen hundreds of bits per day, the cost of resharpening being reduced to such a figure that from the standpoint of economy it is advisable to provide the drill operator with sufficient changes of sharp steel, thereby making it unnecessary for him to worry along with dull or partly broken bits.

The selection of the type of drill bit to be used must be determined in the field, where it is possible to obtain first-hand information regarding the rock that is to be drilled. The ground may be heterogeneous in nature, or of various degrees of hardness, each creating a different problem and requiring special study to determine the proper type of bit to be used.

It should be understood that the bit that will work satisfactorily in one field may prove unsatisfactory in another. This fact has led to the introduction of special bits, to be used in various locations. Thus, in some places the *H* bit has found favor; other places use a cross form of bit, differing from the standard cross bit by having one pair of wings raised at the center,

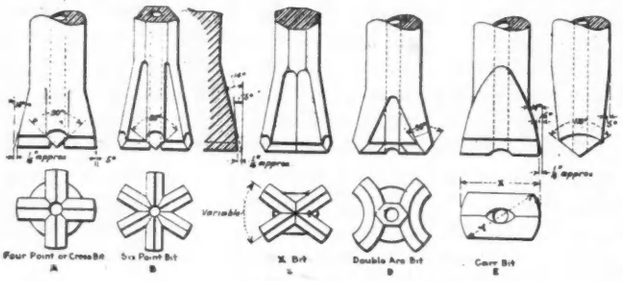


Fig. 2—Types of bits used in machine drilling

approximately $\frac{3}{16}$ of an inch, the corners of the wings being on the same plane. The cross form of bit is also used in the concave shape, in which design the faces of the cutting edges recede as they approach the center of the steel. Then there is the chisel-point bit, used in certain fields, and the bull bit, which is a special blunt bit made for use when drilling soft rock.

The bits mentioned above can be classified as being more or less special, and are gradually being replaced by the standard type of bits that have been perfected by the makers of drill sharpeners. It is therefore with the bits that have thus been developed that we are most interested.

Features of a Good Drill Bit

It may be advisable to state at this time some of the more important points of a properly designed bit.

1. It must take full advantage of the chipping and fracturing of the rock. If the angle of the cutting edge is blunt, it will not take full advantage of the fracture, and if made too sharp it will have a tendency to penetrate past the point of fracture, and will also be more liable to break.

2. The wings of the bit should be as thin as it is practicable to make them, so that proper space is allowed for the removal of the cuttings.

3. The bit must be free in the hole at all times. If sufficient clearance is not provided, the bit will act as a reamer and place undue strain on the rotation parts of the drill.

4. The bit must be symmetrical—that is, all of the ends of the wings must be the same distance from the center of the bit. If one of the wings is longer than the others it will cut a groove in the side of the hole and rifle it.

5. The bit must be properly worked during the sharpening operation; it must not be overheated or worked while too hot or too cold. The forming should be done with light rapid blows in preference to heavy ones. Also, the steel should be allowed to cool after the forging before it is tempered—that is, the forging and tempering should not be done on the same heat.

Fig. 2 shows the bits that are now in general use. At *A* is shown the four-point or cross bit. As will be noted, the angle of the cutting edge is 90 deg. This has been found to give the best results, both from the standpoint of fracturing the rock and withstanding the strain placed upon the bit by the impact against the rock. This angle has practically been adopted as standard for this type of bit. The thickness of the wing must be determined in the field, and should be such that it will stand up under the strain placed upon it. The angle for the flare of the bit is generally made 14 deg., but to reinforce the corners of the wings this angle is changed to 5 deg., as shown. This reinforcing of the corners of the wings adds greatly to the strength of the bit, and is a feature that should be used on all bits when possible. If the bit is formed in a drill sharpener, and the equipment properly made, no trouble should be experienced because of imperfectly formed bits. These machines turn out work that is as near perfection as it is possible to expect, the human element being considered. These machines also form the bit by a series of light rapid blows, thus turning out bits that are far superior to any that could possibly be made by the hand method.

At *B*, Fig. 2, is shown what is known as the six-point or rose bit. The same general characteristics as are noted in the four-point bit are used in the construction of the six-point bit, it differing only in the fact that it has six cutting edges in place of four. The flare angles of 14 deg. and 5 deg. are retained, as well as the 90 deg. angle for the cutting edge. This form of bit is used mostly with the light hammer-type drills that are used unmounted.

At *C*, Fig. 2, is shown the X bit. This bit is similar in form to the four-point bit, except that the angle between the wings varies. In the design of the four-point cross bit this angle is made 90 deg. In the X bit this angle is made whatever the person in charge of the drill steel considers best for the work. One of the main advantages claimed for the X bit is that it will prevent rifling of the hole. This trouble is practically eliminated by the use of machine-made bits, which, being made true to form, remove the main cause of rifling. The X bit, although used to some extent in various fields, is fast being replaced by the four- and six-point bits.

Other Types of Drill Bits

At *D*, Fig. 2, is shown the double-arc bit. As will be noted, this bit is an evolution of the H type. One of the disadvantages of the bits previously described is that the greater part of the wear is at the ends of the wings and is therefore not properly distributed over the cutting edge of the bit. It is claimed that the design of the double-arc bit is such that this trouble is eliminated, the wear being equally distributed. Another claim for this bit is that it drills a perfectly round hole,

that there is only a slight reduction in the gage of the bit as the depth of the hole increased, and that the wear on the cutting edge is uniform throughout its length. The cutting speed of the bit is retained as the depth of the hole advances, and it possesses greater stamina and drills greater distance before change is necessary than some of other types of bits. This bit is easily made in the power drill sharpener if the proper equipment is available.

Referring again to Fig. 2, at *E* is shown the Carr bit. This bit is a development of the chisel-point bit. The cutting edge, however, is made considerably blunter. This bit is found to work well under nearly all conditions and is particularly recommended for use in drilling hard rock. One of the outstanding features of this bit is that the distance across the corners and the cutting edge is the same. This has a tendency to reduce the wear that comes directly upon the corners of the cutting edge in the designs previously described. Consequently, the bit will hold the gage diameter for a much longer period. Another distinct feature is the transverse recess formed across the center of the bit. When this bit is formed on hollow steel, this recess is tapered until it runs into the hole in the steel. In addition to acting as a pilot, this recess reduces the contact surface with the rock to a minimum. When formed on solid steel this recess extends back from the face of the bit approximately ½ in. The following are some of the advantages claimed for this bit:

It holds its gage better than other types now in general use. It requires only $\frac{1}{16}$ in. variation in the diameter of bits, thereby permitting the starting of the hole at a smaller diameter, and thus reducing the amount of rock to be cut.

The bit is free in the hole at all times, thereby reducing the amount of drag on the rotating parts of the drill to a minimum.

It is simple in form and easily made, either by hand tools or with the proper equipment in the drill sharpener.

In drilling rock it is necessary to have the bottom of the hole finish at some predetermined size, the required size at the bottom of the hole determining the necessary variation in the gage or diameter of the bit, so that succeeding steel will follow; and the number of changes of steel necessary to drill to the required depth is the deciding factor for the size of the bit on the first steel. This should be as small as possible to obtain the proper size of finished hole. The speed at which holes are drilled depending to some extent on the size of the hole required, it is therefore evident that this should be kept as small as good practice will permit.

The variation in the size of bits, to permit proper working of the drill and not place undue strain on the rotation mechanism, is generally made ⅛ in., but, as previously stated, the Carr bit requires only $\frac{1}{16}$ in.

Assuming that it is planned to drill a hole 8 ft. deep for use with 1¼-in. explosive, using four-point or cross-bits, the feed of the drill being 24 in., it would be necessary to use four changes of steel, starting with a 1¾ in. bit and following with 1⅝, 1½, and 1⅜ in. bits respectively.

From the foregoing some of the outstanding points to be considered may be summarized as follows:

1. Only the best grade of steel that it is possible to obtain should be used—steel that is specially made for rock drilling.

2. The steel should be heated to the proper temperature for forging, which at no time should exceed 1,600 deg. F. Never forge the bit or shank when the steel becomes too cold; if necessary, reheat to the proper forging temperature.

3. For tempering, heat the steel to the proper temperature (1,450 to 1,500 deg. F.), quenching on a rising heat, never after the temperature has fallen below 1,375 deg.

4. Always quench the steel by holding it in a vertical position.

5. Temper the bits only as far back from the cutting edge as is necessary to obtain the desired results.

6. Anneal the steel after the forging operation by heating to 1,550 deg. F. and covering with powdered lime if possible. Better results in tempering will be obtained.

7. Never forge the shank or bit and temper on the same heat.

8. The quenching bath should be kept cool. If necessary, provide means for agitating the water (or oil) to prevent its heating too rapidly.

9. The shank should be kept in good condition, free from rough ends, and up to size.

10. The hole in the shanks of hollow steel should be in center of shank and of the required size and depth, so there will be no interference with the water tube.

11. Bits should be true and of proper design, the question of design to be determined in the field to meet existing conditions.

12. The size of the hole drilled should be kept as small as possible. This will reduce the amount of rock that must be cut and help to speed up the drilling operation.

13. The variation in the gage of the bits should be such that the following steel will not be tight in the hole and place undue strain on the rotation mechanism of the drill.

14. Inspect carefully all steel before it is sent out for use. See that the shank is properly formed and hardened, and free from roughness. Examine the bits for proper gage, uniformity, and hardness. Be sure there are no cracks or flaws in the steel which would cause it to break during the operation of the machine.

New Outlet for Copper in the Fishing Industry

When fresh-water organisms infect drinking water minute amounts of copper sulphate added to the water supply soon kill the growths. There are 200,000 men in this country earning their living by fishing. Marine growths attack their ropes and nets so rapidly that they have to replace about 200,000,000 lb. of rope annually. In the past they have tried to protect their ropes by applying tar compounds. But the marine organisms literally "eat the tar out of" the rope and then attack the rope itself.

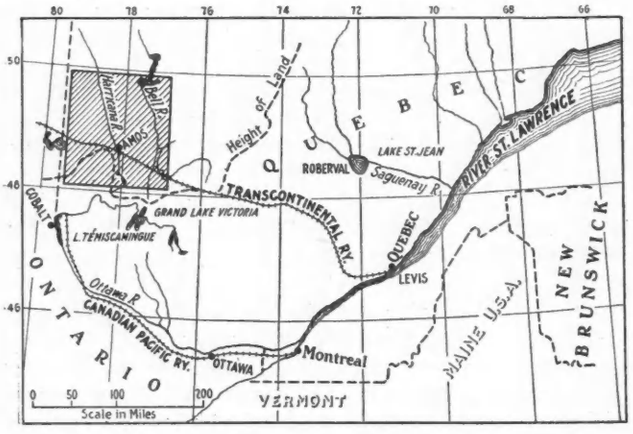
The Bureau of Fisheries has recently discovered that copper compounds will kill these organisms, and has worked out methods of applying the copper in oil solutions to the rope. Such a mixture not only will protect a cable from marine growth but also from mold and other micro-organisms that rot it. It is believed that in the future considerable demand will result for copper sulphate for this purpose, according to the *Wall Street Journal*.

Prospects for Gold in Northwestern Quebec

Favorable Geological Features of the Abitibi Region—Correlation With Ontario Mining Districts—Prospecting—Many Claims Staked—Accessibility

By Theo. C. Denis
Superintendent of Mines, Province of Quebec

THE AREA in the recently established county of Abitibi, in the Province of Quebec, where an influx of prospectors is taking place at the present time, holds great promise of developing into a productive gold field. For more than a quarter of a century, geologists and mining engineers have been calling attention to the importance of the pre-Cambrian area, and of its rocks. These are the oldest known, and have been widely and intensely subjected to metallogenic agencies. These pre-Cambrian rocks, which constitute the Laurentian Shield, or backbone, of the North American continent, outcrop over an area of more than 1,800,000 square miles. Apart from two small spurs, one of which projects into the State of New York and the other of which lies southwest of Lake Superior, this



Map showing location of mineralized area in northwestern Quebec

exposure is wholly in Canada, and occupies over 600,000 square miles in the Province of Quebec. In the United States the Lake Superior spur contains the iron mines of Michigan, Wisconsin, and Minnesota, and the famous copper deposits of Michigan. In Ontario the pre-Cambrian rocks are responsible for the nickel deposits of Sudbury, the gold deposits of the Lake of the Woods, the silver mines of Cobalt, the gold mines of Porcupine and Kirkland Lake. In Quebec the mineral resources which they may contain are yet lying dormant.

Mineralized Region of Abitibi County

The mineralized district which has come to the front in the last ten months occupies the southwest part of the county of Abitibi, adjacent to the interprovincial boundary between Quebec and Ontario. Immediately east of this boundary there is an area of about 12,000 square miles, approximately comprised between longitudes 76 deg. 30 min. and 79 deg. 30 min. and latitudes 48 deg. and 50 deg. (see sketch map), underlain by what may be designated as an immense outlier of Keewatin rocks (Abitibi group), embedded or inclosed in the Laurentian Shield. The basal rocks of this Keewatin area are metamorphosed volcanics, possessing in the main a more or less schistose structure, and ranging in composition from ultra-basic basalts to rhyolites. Overlying these rocks, or inclosed in them, are bands or zones of greatly altered sedimentaries, conglomerates, graywackes, and slates, to which the local name of Pontiac schists has been given, and which are the equivalents of the rocks of the Temiskaming series in Ontario. All these rocks have been cut and invaded by syenites, granites, and various porphyries, of post-Laurentian age (Algoman). According to P. E. Hopkins, one of the geologists of the Ontario Bureau of Mines, "All the known important gold deposits of Ontario appear to have been formed during the Algoman epoch. They are found chiefly in Keewatin, Grenville, and infolded Temiskaming sediments which have been intruded by Algoman granites and porphyries. The deposits at Porcupine, Kirkland Lake, Boston Creek, Matachewan, Deloro, and elsewhere are believed to belong to this epoch." It is therefore apparent that there are in this Quebec area geological conditions practically identical with the ones which have given rise to the producing gold camps of Ontario.

Two Gold Belts in Northern Ontario

In a preliminary report issued in October, 1922, by the Ontario Bureau of Mines, it is pointed out that there are in northeastern Ontario two main gold-bearing zones, which follow two belts of Temiskaming sediments, running east and west and roughly parallel to each other. They are 25 to 40 miles distant from each other. The northern one, which begins at Porcupine, and has been traced 70 miles easterly, contains the Dome mine, the Croesus, and the Lightning River prospects, the latter being near the Quebec boundary. The second, or southern, gold belt has also been traced for 60 miles from the Matachewan area, through the Kirkland Lake, to the Larder Lake deposits in Gauthier, McGarry, and Hearst townships.

Extension of Gold Belts Into Quebec

It is on the extension into Quebec of the Matachewan-Kirkland-Larder gold belt that the recent prospecting "rush" has taken place. The townships of Dasserat, Boischatel, Rouyn, Joannès, Dufay, Dufresnoy, and Montbray have been the main scenes of activity. Before the winter snow covered the ground, sufficient preliminary work, comprising stripping, trenching, and sampling, had been done on many claims to justify the holders to bring into the district, over the winter roads, diamond drills and light mining equipment to carry on exploration and development.

During the summer of 1922, two geological parties, sent in by the Department of Mines, under H. C. Cooke, made a preliminary examination of the district, and, although the report has not yet been published, it is understood that the government geologists are favor-

ably impressed with the conditions in the field, and the tract of country over which they went appears to warrant expectation of the development of future gold mines. Numerous large bodies of porphyry were noted, as well as syenite and granite intrusions; and, taking into account the keynote of the advice of official geologists of the Ontario Bureau of Mines to the prospectors, which can be summed up into one sentence, "*For gold deposits look for feldspar-porphyry* and *quartz-porphyry intrusions in or near the great belts of pre-Cambrian sediments, particularly the Temiscaming series*," this area in the Province of Quebec is most promising.

Prospect Work and Geological Exploration

The influx of prospectors in the region began in March, 1922, and by the end of the summer 35,000 acres had been staked out in mining claims. The rush continued all winter, but, necessarily, with several feet of snow on the surface, the staking of claims during the winter season was more or less haphazard with respect to the value of the ground as mining land. However, sufficient stripping and trenching had been done during the summer of 1922 to throw considerable light on the possibilities. The results of this work, coupled with the geological exploration done during the last field season by the Geological Survey of Canada, have so far been most encouraging.

By the middle of March of this year the records of the Quebec Bureau of Mines showed that, in round numbers, during the last twelve months, 640 claims, covering 86,000 acres, had been staked and registered, distributed as follows: Rouyn, 340 claims, covering 44,800 acres; Boischatel, 120 claims, 18,000 acres; Joannès, 60 claims, 8,000 acres; Dufresnoy, 45 claims, 6,400 acres; Dasserat, 35 claims, 4,400 acres; Dufay, Montbray, Montbellard, Bellecombe, together, 40 claims, 5,000 acres. More than 60 per cent were staked in winter, and assessment work on them will not begin before April or May, but on some of the earlier claims, in Dasserat, Boischatel, and Rouyn, stripping and channel sampling have been done, revealing considerable bodies of ore. It is remarkable that few assays have been blank. Contents of $7 to $15 a ton are numerous, and several grab samples have given high results.

Though nothing spectacular has come to light, the indications of the possibilities of large tonnages are good in several places. In Rouyn Township, a group of claims on Héré Lake has been optioned to a Toronto syndicate, organized by M. J. Hammil, and on one of these claims two diamond drills are at work, the drilling being in charge of Messrs. Smith and Travers, of Sudbury. Another group, organized by Messrs. Thomson and Chadbourne, under the name of "The Noranda Mines, Ltd.," controls several claims, among them the Powell claim and the Horne claim, two of the earliest staked. On the first of these, the construction of a mining camp has been going on this winter, and mining equipment is on the ground with which to start a 300-ft. shaft. This syndicate is negotiating with the Smith and Travers company to diamond drill the Horne claim.

In Boischatel, an Ottawa group did much stripping and trenching on a group of claims near Lake Fortune, under the direction of a competent geologist, and the results, though not brilliant, are sufficiently encouraging to justify the renewal of active exploration this coming spring.

The district can be reached by several routes. From Ville-Marie on the upper part of Lake Temiskaming, a road, over which automobiles can travel during the greater part of the year, is opened as far as Gillies Bay, 24 miles, whence a water route navigable by gasoline launches can be followed right into Rouyn Township.

Another route is by North Temiskaming, over a good road, 25 miles long, as far as Lake Opazatica. Lake Opazatica is then followed by canoe or launch for 20 miles into Dasserat Township, whence a trail, along a winter road, is taken for 17 miles into Rouyn Township. Still another route can be taken from the Transcontinental, at La Sarre, and a fourth from Dane station, on the Temiskaming & Northern Ontario Ry.

Should the new field develop into an important producing gold camp, the question of power may become a factor of importance. On the Ottawa River, at Quinze rapids, which is only 40 miles in a straight line from the center of present activities, there are rapids and water falls from which 100,000 hp. could be developed. Another important water-power, also in the Ottawa River above Lake Expanse, is 30 miles distant. Besides these there are several small falls and rapids on the Kanojévis River, within a few miles of Rouyn and Boischatel townships, which could be harnessed for local use.

Costs at the North Star Mines

The annual report of the North Star Mines, in Grass Valley, California, gives some interesting figures of gold production costs.

A total of 154,569 tons was delivered to the sorting plant, of which 38,969 tons was discarded as waste, leaving 115,600 tons crushed, with an average yield of $9.41 per ton crushed, at an average cost per ton of $6.99 for operating and $1.14 for development, making an aggregate cost of $8.136 per ton crushed ($6.10 per ton mined), and leaving a realized profit of $1.27 per ton crushed. The yield per ton in 1922 was 78c. and the cost per ton 12c. less than the average for the period of the five preceding years.

The results obtained may be otherwise compared by stating that the average cost of producing $1 in gold was 86½c. in 1922 and 81c. in the five preceding years. For the five years beginning with 1912 the average cost of producing $1 in gold was 54c. The higher cost of producing a unit of gold in the last six years, compared with the preceding five years, may be ascribed almost entirely to increased expense due to the economic conditions resulting from the war, and only slightly to a lower gold content per ton of rock crushed. This is evidence again of the handicap under which the business of gold mining is now being carried on, with the price of the product remaining constant at all times, while the cost of labor and supplies, and taxation also, have so materially increased.

Of the total production of the year 82.67 per cent was obtained in the mill by amalgamation, and 17.33 per cent was recovered by cyanidation. It is estimated that the value lost in the tailing was about 27c. per ton crushed. Following are operating details:

	Per Ton Mined	Per Ton Crushed
Mining	$3.757	$5.010
Milling	.412	.549
Cyaniding	.307	.410
Tailing disposal	.096	.128
Bullion	.019	.025
General expenses, Grass Valley	.239	.318
New York	.119	.158
Taxes	.223	.298
Accident and benefit	.084	.112
Total	$5.256	$7.008
Less sundry receipts	.012	0.16
Total operating expenses	$5.244	$6.992

USEFUL OPERATING IDEAS

Useful Fan Calculations

BY WALTER S. WEEKS

To determine what a fan will do under a given set of conditions, it is necessary to have a fan characteristic at some speed. This characteristic is a curve that shows the volumes of air delivered by the fan and the corresponding pressures at which these volumes may be obtained.

In a previous article[1] I explained the fan characteristic and showed how, if a characteristic at one speed is known, characteristics for other speeds may be obtained. Another type of calculation which is often serviceable is this: A characteristic at some speed is known; it is desired to force a given amount of air through a duct, and the pressure necessary to do this has been determined. At what speed must the fan be run to accomplish this? The calculation may best be explained by means of an example:

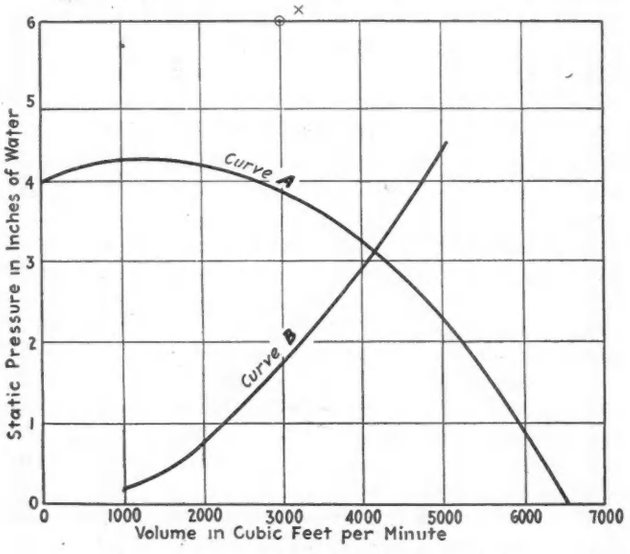


Fig. 1.—Curve "A," fan characteristic. Curve "B," pipe curve

Curve *A*, Fig. 1, is the characteristic of a fan at 1,000 r.p.m. It is desired to force 3,000 cu.ft. of air through a pipe, and it has been ascertained that a pressure equivalent to that of 6 in. of water is necessary to do this. At what speed must the fan be run?

The problem is, essentially, to find the speed at which the characteristic passes through the point whose coordinates are 6 in. water gage and 3,000 cu.ft. per minute. This point is marked *X* in the figure.

Now, if we wished to construct a characteristic at some speed other than that at which the known characteristic is made, it would be necessary to select points on the known characteristic and multiply the volumes by the ratio of speeds and the pressures by the square of the ratio of speeds, in order to obtain points on the new characteristic.

Now, we are reversing the process and trying to find the point on the known characteristic from which *X* would be obtained. If the volume at *X* is obtained from a volume at a point on the known characteristic by multiplying by the speed ratio, then the volume at the point on the characteristic would be obtained from the volume at the point *X*, by dividing the latter by the speed ratio.

As *X* lies above the characteristic, we know that the speed must be increased. Assume a ratio of speed, say, 1.3. Then $3,000 \div 1.3 = 2,308$. The water gage on the known characteristic for 2,308 cu.ft. is 4.13 in. If we have made the correct assumption for the speed ratio, this pressure multiplied by the square of the speed ratio should give 6 in.

$(1.3)^2 \times 4.13 = 6.98$. We have evidently made an incorrect assumption. A few trials will show 1.21 to be the correct ratio. $3,000 \div 1.21 = 2,480$.

The pressure at this point is 4.08.

$(1.21)^2 \times 4.08 = 5.97$. So the fan must be run at $1.21 \times 1,000 = 1,210$ r.p.m. to give 3,000 cu.ft. per minute at a water gage of 6 in.

In the article to which reference was made in the footnote, I showed the method of ascertaining how much air a fan run at a given speed would force through a given pipe. It is possible that the operator may have at hand a lot of pipe of different sizes and would like to increase the air delivered by laying several pipe lines in parallel, which would be supplied by a single fan. The problem is to find how much air the fan will force through the pipes.

Consider Fig. 2. It represents a single fan blowing into a manifold which connects with three pipes, each 1,000 ft. long. The fan characteristic is curve *A*, Fig. 1. What will be the total air flowing and how much will pass through each pipe? The fan will maintain some pressure at the junction of all three pipes. The pressure at the open ends of the pipes is atmospheric, so the drop in pressure is the same in all the pipes. To find what proportion of the total air will flow in each pipe, we make use of the friction chart printed in the article referred to.

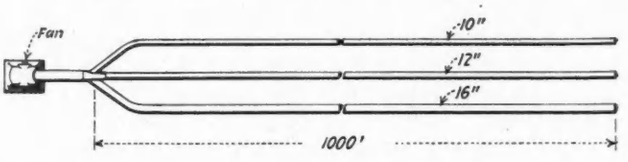


Fig. 2.—Diagrams showing fan pipes in parallel

Assume a drop of pressure of 1 in. of water and determine from the chart what quantity flowing in each size will give this drop. Inspection shows the quantities to be these:

[1]Selection of Fans for Pipe Ventilation, *Engineering and Mining Journal-Press*, May 13, 1922.

In the 10-in. pipe, 1,250 cu.ft. per minute.
In the 12-in. pipe, 2,050 cu.ft. per minute.
In the 16-in. pipe, 4,100 cu.ft. per minute.

The fraction of the total air that will flow through any one pipe is the quantity just determined for that pipe, divided by the sum of the three quantities. For example the fraction of the total air that will flow through each pipe is determined as follows:

10-in. pipe $\frac{1,250}{7,400} = 0.169.$

12-in. pipe $\frac{2,050}{7,400} = 0.277.$

16-in. pipe $\frac{4,100}{7,400} = 0.554.$

Whatever be the total air flowing, 16.9 per cent will pass through the 10-in. pipe; 27.7 per cent will pass through the 12-in. pipe; and 55.4 per cent will pass through the 16-in. pipe.

Now, to determine how much air the fan whose characteristic is curve *A*, Fig. 1, will force through the pipe, plot on the same sheet as the fan characteristic, a curve that shows the drop in pressure in one of the pipes against total air flowing. The curve will be identical for all the pipes.

Let us plot for example the curve for the 10-in. pipe. Assume a total quantity of air. Take 16.9 per cent of this and determine by use of the friction chart the pressure necessary to force this quantity through 1,000 ft. of 10-in. pipe. Plot this pressure against total assumed air. Plot sufficient points to make the pipe curve cross the fan characteristic. The pipe curve is curve *B* in Fig. 1. The crossing indicates the total air that will reach the breast. In this case the total air will be about 4,200 cu.ft. per minute.

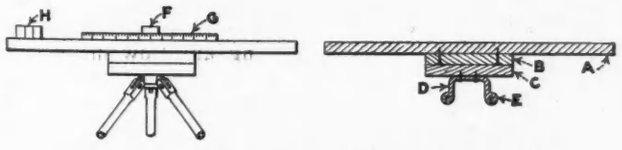
To determine how much will flow in each pipe, multiply 4,200 by the percentages already determined for the division of the air.

Transit Made Into a Plane Table

BY E. E. CLARKE

An extra plane table being needed at once, one was constructed from a transit and drawing board as shown in the accompanying sketch.

A is a 24x30-in. drawing board $\frac{7}{8}$ in. thick. *B* is a



Sketch showing construction of plane table

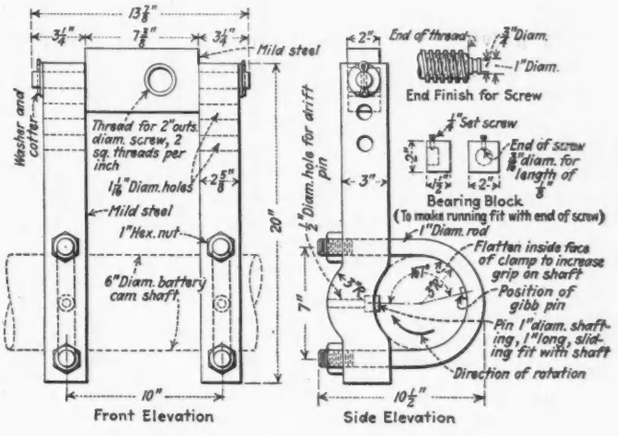
circular board 1 in. thick and 12 in. in diameter, fastened firmly to *A* by four screws with heads countersunk in *B*. *C* is also a 1-in. board 12 in. in diameter; *D* is the cap used for covering the tripod when not in use; *E* is the tripod head. *C* is fastened firmly to *D* by four screws. A ½-in. bolt with its head countersunk in *B* extends through *B*, *C* and *D*, with a wing nut for clamping. The rotating surface is between *B* and *C*. The board is leveled up by a Brunton compass, *H*, by means of the adjustable tripod legs.

The alidade is made as follows: *G* is a 1x4x18-in. board with a beveled-edge scale; *F* is the metal screw plate taken off the base board on which the instrument is fastened when put in its case. *F* is fastened firmly to *G*. The instrument is then screwed onto *F* and the line of sight is kept parallel to the edge of the scale. When the transit is in good adjustment, it is necessary at each observation to center the plate bubble that is parallel to the telescope. Good work was done with this makeshift plane table, and almost as quickly as it can usually be done with the standard plane table.

Improved Camshaft Jack

BY H. S. WORCESTER

At the Smuggler mill of the Smuggler Union Mining Co., at Telluride, Colo., a camshaft jack has been used since last June for loosening battery cams from the camshaft. These cams are held by the usual gib key. The old method of removing them from the shaft with a hammer often required considerable time and



Details of battery cam jack.

frequently resulted in breaking them or, at least, battering them. The accompanying drawing shows the jack now in use. When a shaft is equipped with cams, holes are countersunk at the position shown with respect to the key on both sides of the hub of the cam, in a 6-in. camshaft for 1-in. pins. When a cam is to be loosened, the camshaft jack is set up with 1-in. pins in place in these holes and the U-bolts are pulled up tight. The jackscrew is then run against the cam with the bearing block in place against the drop-side face of the cam. A few raps with a hammer when the jack pressure is exerted readily serve to loosen the cam from the key. The old method took from one hour to five hours, and the jack as used the first time required forty-five minutes, with no damage to the cam. The jack was designed by H. G. Palsgrove, manager, and worked up by Mr. Lyster, formerly mechanical engineer for the company.

Repair of Worn Clevis

BY CHARLES LABBE

A worn clevis may be repaired in the following manner: The shank, if not already round, can be turned or filed down and threaded to the nearest size of pipe threads. The clevis is then cut with a hacksaw for its full length on one side only. A hexagon nut tapped to the size of thread used is screwed on the clevis shank. When the nut is tightened, the shank will be clamped firmly to the rod that has been screwed into it.

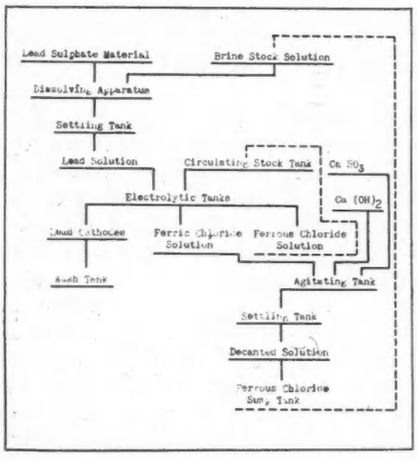
Recent Patents

Extraction of Precious Metals—No. 1,447,140. Feb. 27, 1923. C. C. McBride, Sanger, Calif. Precious metals are extracted from ore by agitating the ore with a solution of an alkali-metal chloride, at the same time passing an electric current through the mixture from an insoluble anode to an amalgamated lead cathode.

Ore Roasting—No. 1,447,645. March 6, 1923. M. F. Chase, Cleveland, Ohio, and F. E. Pierce and John Skogmark, New York City, assignors to the Cos Process Co., Inc., New York City. A method of roasting sulphide ores of copper, iron, zinc, and other metals which includes the introduction of oxygen gas to assist the reaction.

Electric Smelting — No. 1,447,892. March 6, 1923. Richard Rodrian, New York City, assignor to Rodrian Electro-Metallurgical Co., Inc., New York City. To the ore is added melted a nitrate and carbonate of the same alkali, and to the mixture is then added metallic lead. The molten mass is then electrolyzed.

Electrolytic Lead — No. 1,448,923. March 20, 1923. F. N. Flynn, East Orange, N. J., and G. D. Van Arsdale, New York City. Current is passed through a brine solution containing both



lead and a substance capable of acting as a depolarizing agent at the anode during electrolysis. The flow sheet is shown in the accompanying cut.

Silver Recovery—No. 1,448,475. March 13, 1923. Louis Weisberg, Grantwood, N. J. Silver is recovered from the solutions used in photographic work by adding sugar and a sufficient amount of alkali to cause substantially all of the silver to be precipitated.

Classification—No. 1,448,514. March 13, 1923. W. O. Borcherdt, Austinville, Va., assignor to the New Jersey Zinc Co., New York City. Colloidal matter is dispersed or deflocculated, then removed from an ore pulp, after which the remaining pulp is subjected to wet classification. Patent No. 1,448,515 covers substantially the same process.

Reducing Ores—No. 1,448,340. March 13, 1923. Emil Fleischer, Dresden, Germany, assignor to the Chemical Foundation, Inc. A method of passing a reducing gas through a large body of ore in superposed inverted conical-shaped compartments, with various inlet and outlet ports for the gas.

Mine Car—No. 1,448,103. March 13, 1923. S. A. Worcester, J. L. Bruce, and L. S. Farnham, Butte, Mont. A new design of dumping car for mine use.

Lifting Furnace Doors—No. 1,448,481. March 13, 1923. L. D. Bedell, Bethlehem, Pa. A method of lifting vertically operating furnace doors by attaching the top of the door to a counterbalancing weight, power being supplied when the door is to be lifted or lowered.

Technical Papers

Canadian Mineral Production—A preliminary report of the mineral production of Canada for 1922, pp. 49, is available from the Dominion Bureau of Statistics, Ottawa, Ont., on request. The total value was $183,000,000, compared with $172,000,000 in the preceding year. The production of all metals increased in quantity and value, with the exception of copper, nickel, and iron. Large increases over the previous year are reported for arsenic, mica, and talc.

Madagascar Mining—We are in receipt of the first number of *Bulletin des Mines de Madagascar*, to be published monthly by the Director of Mines, Tananarive, Madagascar, the subscription price being 6 francs per year. The current number is of sixteen pages and contains a six-page article on asbestos, together with several shorter contributions.

Patents and Trade Marks—Richards & Geier, 277 Broadway, New York City, have issued the second edition of "Patents: Law and Practice," pp. 56; and the third edition of "Trade Marks, Trade Names, Unfair Competition," pp. 46. They may be obtained free. Though published for advertising purposes, these are valuable handbooks for those interested in the subjects, and the uninitiated will find them comprehensible and informative.

Mineral Resources — "Gold, Silver, Copper, Lead, and Zinc in Colorado in 1921," pp. 32, is now available free from the U. S. Geologocal Survey, Washington, D. C. The bulletins in this series cover the development and production of the various mines and districts in more or less detail.

Liquid Oxygen—There is a long discussion of Alfred James's recent paper on "Liquid Oxygen in Mining" in the *Bulletin* of the Institution of Mining and Metallurgy for March. (Cleveland House, 225, City Road, London, E. C. 1, England; price not stated.) Much interesting information on this novel practice is offered.

Societies, Addresses and Reports

A.I.M.E. Plans for Fall Meeting

President E. P. Mathewson announced at a meeting of the San Francisco Section, April 2, 1923, that the preliminary plans for the fall meeting of the American Institute of Mining and Metallurgical Engineers were about completed. If 125 or more members are secured, the plan is to leave New York on Aug. 19, 1923, by special train, reaching Toronto, Canada, Aug. 20. Aug. 22-23 will be spent at Sudbury; Aug. 24 at Kirkland Lake; Aug. 25 at Porcupine; Aug. 26-27 in a visit to various pulp-making plants; Aug. 29 with technical session at Quebec and a visit to the asbestos mines; on Aug. 30 there will be a meeting in Montreal, and on Aug. 31 the party will return to New York. The expense for the excursion is estimated at $200 per member.

Mr. Mathewson, in urging the solicitation of new members, stated that whereas the dues brought in about $11 per member the annual expense was about $20 per member. The difference is derived from returns from investments and income from advertising in the Institute's publication *Mining and Metallurgy*. Mr. Mathewson stated regretfully that the membership of the Institute showed a continual falling off.

Ruhr Situation Discussed at New York Section Meeting

C. A. Le Neveu, French Commercial Attaché to the United States, and M. Ingous, formerly Secretary General of the Society of Civil Engineers in France, explained the conditions in the iron and coal mining industries of France and the bearing of the Ruhr situation, at the regular monthly meeting of the New York Section of the A.I.M.E. held at the Chemists' Club on the evening of April 4. Dinner preceded the technical session.

Mr. Le Neveu showed that in the Ruhr district the output of coal and coke prior to the occupation of the French was only 82 per cent of that in 1913, although the potential production was fully as great as before. He ascribes this to deliberate sabotage on the part of the Germans. As a result of the devastation and flooding of coal mines in northern France during the war, the complete restoration of which will require at least ten years, the French iron and steel industry is now dependent upon fuel from Germany. Mr. Ingous told of the engineering problems connected with rehabilitating the flooded mines, the openings into which had been destroyed in many instances. Tedioùs work, requiring reinforcement with steel and concrete, is necessary to rehabilitate these properties. Though much has been accomplished, a great deal more remains to be done.

MEN YOU SHOULD KNOW ABOUT

Patrick Daly, of the Portland Canal district of British Columbia, is in New York.

D'Arcy Weatherbe is on his way to India, through Constantinople and Bagdad.

George D. Blood, general manager of the Park Utah Mining Co., is in San Francisco.

J. A. Burgess, consulting geologist of San Francisco, is in Tonopah on professional business.

John W. Finch is back at his office in New York after a trip through Europe, the Near East and Egypt.

J. K. Turner has returned to Goldfield, Nev. after a trip of several weeks' duration in the Oatman district of Arizona.

R. L. Chase, of Denver, has left for Mexico, where he will remain through the month of April engaged in geological investigations.

Stewart Campbell, Idaho state mine inspector, was recently a guest of honor and speaker at a luncheon given by the Salt Lake Chamber of Commerce.

G. B. D. Turner, managing director of the Indian mine, in the Stewart district of British Columbia, has returned from an extensive trip to Montreal and Toronto.

Dr. George Otis Smith discussed the strategic minerals in an address delivered on April 6 before the senior class at the United States Military Academy.

N. O. Lawton has returned from New York to his office in Salt Lake City. He expects to spend the next four weeks at Eureka, Nev., engaged in professional work.

Dean L. S. Grant, of the Colorado School of Mines, with a delegation of students, last week inspected several mines and smelters in the vicinity of Salt Lake City.

T. Evans, general manager of Greene-Cananea, has returned to his headquarters in Cananea, Sonora, Mexico, after several weeks in California, where he went in hope of benefiting his health.

Clarence Woods, mining engineer of Orland, Calif., sailed from New York on April 5 for Antofagasta, Chile. From there he will go to Pulacayo, Bolivia, in the interest of the Huanchuca Mining Co.

Dr. R. B. Moore, chief chemist of the Bureau of Mines, will discuss hafnium and other rare and suspected elements before the New York Section of the American Chemical Society on June 8.

Maurice W. Summerhayes, mining engineer of Toronto, has been retained by the Argonaut Gold, Ltd., to cooperate with that company's engineer in completing the construction of the new mill.

Arthur J. Hoskin, research assistant professor of mining, has been appointed as the acting head of the department of mining, University of Illinois, to fill the vacancy caused by the sudden death or Dr. H. H. Stoek, the founder of the department of mining at Illinois.

After graduating from the University of Wisconsin in 1890, Professor Hoskin went immediately into active mining work, as assistant to a mining engineer at Idaho Springs, Colo. This work covered mineral and patent surveys and mine developments. The next position was as assayer for the Omaha and Grant smelter at Denver. He next took the position of selling agent for twelve of the mines at Cripple Creek and Leadville, and also spent one year in the U. S. Surveyor General's office

Arthur J. Hoskin

at Denver. Then he was consulting engineer at Leadville. From 1903 to 1906 he was chief engineer for the Leyden Coal Co., opening and operating one of the mines in a new district, near Denver. He designed and erected the first automatic coal machinery, such as cagers, weighers, and box-car loaders, used west of Iowa, and received the degree of Mechanical Engineer from Wisconsin on the basis of this experience. He then began teaching, and was for two years assistant professor of mining at the Colorado School of Mines, and then full professor for four years at the same institution, which at that time was the largest mining school in the country. He taught every course in the mining curriculum there at various times during his six years. He was in business for himself in Denver from 1917 to 1920, and then became mill superintendent for the Colorado United Mines Co. Professor Hoskin is an authority on American oil shale, has had considerable editorial experience, and is the author of a number of mining bulletins. He is a member of the A.I.M.E., the Colorado Scientific Society.

Karl Baumgarten, one of the mining engineers on the staff of the U. S. Bureau of Mines, who has been on duty at the St. Louis office, has been detailed for service with the War Minerals Relief Commission.

Lapsley W. Hope, who has been superintendent of the Ocoee Copper Co. at Ducktown, Tenn., for the last three years, has severed his connection with that company. His present address is Copperhill, Tenn.

H. T. Marshall formerly mining engineer for the Mead Iron Co. at the Warren mine, Hibbing, Minn., left Tuesday for Kimberly, Nev., where he will join the engineering staff of Consolidated Copper Mines Corporation.

Arthur F. King, business manager for *Engineering and Mining Journal-Press*, will resign that position, effective April 15. Mr. King will resume business affiliations with the Marion Steam Shovel Co., at Marion, Ohio.

W. A. Robbins, of Hibbing, Minn., has resigned his position on the engineering staff of the Arthur Iron Mining Co., and will leave soon for Mellen, Wis., where he has accepted a position as engineer for the Berkshire mine.

F. F. Sharpless, Secretary of the American Institute of Mining and Metallurgical Engineers, was recently in Toronto making preliminary arrangements for the excursion of the Institute to the mining districts of northern Ontario.

Arthur Crowfoot, originally selected to take charge of the Copper Queen concentrator at Bisbee, Ariz., will be unable to go to Bisbee. He will remain at the Phelps Dodge mill at Morenci, Ariz., to supervise alterations at that plant. **Ernest Wittman**, assistant superintendent of the Morenci mill, will take charge of the Bisbee concentrator.

The Alaska Agricultural College and School of Mines at Fairbanks, Alaska, recently received from **Stephen Birch**, president of the Kennecott Copper Corporation, a check for $2,000, to be used in building up a reference library. With the material on hand this added help gives the new college in the North the finest technical reference library in Alaska.

J. W. Paul will act as chief mining engineer of the U. S. Bureau of Mines for the next year. This is made necessary by the fact that **George S. Rice**, the Bureau's chief mining engineer, will be absent for five months doing special work in Europe. On his return he will not assume his regular duties until after he has completed the extended reports which he will write.

Mining and metallurgical engineers visiting New York City last week included: **A. H. Silverstein**, of State College, Pa.; **J. B. Wilmarth**, of Minneapolis; **L. Wheeler**, of Pittsfield, Mass.; **David F. Baker**, of Johnston, Pa.; **W. H. Whittier**, of St. Louis, Mo.; **I. E. Waechter**, of Providence, R. I.; **Dorsey A. Lyon**, of Washington, D. C.; **and Stanley C. Herold**, of Pittsburgh.

THE MINING NEWS

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Leading Events

THE Director of the Mint has made public the legal opinion upon which is based his decision to exclude 10,000,000 oz. of silver used for subsidiary coinage from the total repurchases under the repurchasing provision of the Pittman Act.

The Anaconda Copper company has bonded the Marble Bay copper mine, on Texada Island, British Columbia.

A copper-wire plant is projected at the Tacoma smelter.

Additional converting equipment is being installed at Miami, Ariz., by the International Smelting Co.

Increased activity throughout Colorado is reported.

Preparations are under way for a rush to the new gold areas of northeastern Quebec when the winter breaks.

The Wright-Hargreaves company will double the capacity of its mill in Ontario.

Excellent ore has been opened in the Ontario mine in Park City, Utah, at a point beyond the main fault.

The Mother Lode Coalition (Alaska) mine materially increased production in March.

A permanent safety-first station will be provided at Wallace, Idaho.

Kennecott Assured of Control of Utah Copper Company

Will Make Potential Production 50,000,000 Lb. of Copper Per Month—Well-Balanced Organization

The action of the stockholders of the Kennecott Copper Corporation approving the increase in capital from 3,000,000 shares to 5,000,000, all of no par value, and to increase the stated capital from $15,000,000 to $25,000,000, assures the company's gaining control of the Utah Copper Co. by purchase of Utah shares.

Kennecott now owns about 38 per cent of the Utah stock, and it is understood that enough large Utah stockholders have signified their willingness to turn their holdings over to Kennecott on the basis of one share of Utah for one and three-quarters shares of Kennecott to more than assure control.

To take over the remaining 62 per cent of Utah would require approximately 1,763,975 shares. The remaining 236,024 shares of the 2,000,000 additional authorized can be sold by the directors when funds are needed for corporate purposes.

Combined control of the two companies will work to the advantage of both. It will concentrate the production of both companies under one head and will increase the importance of Kennecott in the copper industry, in which it already has a dominating place. Stephen Birch, of the Kennecott company, says:

"In 1915 we took over some Utah Copper stock, with the object of getting a well-balanced copper property, with mines in Alaska, Utah, Nevada and South America. We feel that this has been practically accomplished. Strikes, embargoes and other unforeseen developments can overtake any individual mine, but with a well-balanced property it is felt the organization is in excellent position to meet future developments, whatever they may be. It may be impossible to get hold of every share of stock outstanding. Even now we have not obtained all the outstanding stock of Braden Copper Co., about 1 per cent remaining in the hands of outside stockholders."

Mr. Birch said that, with control of Utah, Kennecott would have potential output from its own and subsidiary properties of about 600,000,000 lb. of copper per year and that its cost of production would be the lowest for this tonnage in the world. He stated that Kennecott is now earning at the rate of between $5 and $6 a share a year. Braden's cost of output is now 8.33c. a pound delivered to consumer; March output was 11,400,000 lb. and since Jan. 1 output has averaged 10,600,000 pounds a month. Utah's cost of production is practically the same as Braden's, and Mother Lode is producing for under 7c. a pound.

Ford Buys Bauxite Mines in Georgia

Henry Ford has purchased six bauxite deposits in southern Georgia for a sum estimated at from $500,000 to $1,000,000. This is interpreted by many to mean that he still expects to get Muscle Shoals, as his original plans were said to include the manufacture of aluminum at Muscle Shoals.

In northern Georgia and east Tennessee there are numerous bauxite deposits, and it is said that Ford's engineers have looked over many of these also.

Permanent Safety-First Station for Coeur d'Alene District

K. T. Sparks Will Have Charge of Cars at Wallace—Recent Fires Emphasize Need for Service

Although the large mining companies of the Coeur d'Alene district, Idaho, have long given much attention to safety-first measures, which includes training in first aid to the injured and in the use of helmets and other equipment for use in rescue work in case of underground disaster, the recent fires in the Morning and Hercules mines demonstrated that more effective facilities should be provided through cooperation of all the companies. The matter was taken up by the Coeur d'Alene Mine Owners' Association with the director of the Bureau of Mines, the proposition being permanently to place one of the Bureau cars at Wallace in charge of an experienced man, whose duties would be to supervise training men at the various mines and see that all necessary equipment was provided and kept in serviceable condition, at the same time maintaining the car and its more elaborate equipment ready to respond promptly when called to any mine in the district. On March 27 F. J. Bailey, assistant director of the Bureau, and D. J. Parker, chief of the safety service, arrived in Wallace and conferred with the representatives of the various mines, with the result that the plans outlined were adopted. A Bureau car now at McAlester, Okla., will be sent to Wallace and will be placed in charge of K. T. Sparks, who was sent to the Coeur d'Alenes at the time of the recent fires, in charge of Car. No. 9, which will remain at Wallace until the permanent car arrives.

Mild Activity in Clear Creek County, Colo.

Several Mills in Operation—East Butte Remodeling—Development of Various Properties Progresses

BY W. H. STAVER

Operations will be resumed at Silver Plume, in Clear Creek County, Colo., by the East Butte Mining Co. about May 1, when 500 tons of ore per day will be milled. The company is remodeling the mill at the present time.

Equipment includes crushers, tube mills, the Ruth rod mill, Janney flotation machines and Deister-Overstrom tables. The concentration ratio is about 25 to 1. Mill heads average from 4 to 6 oz. silver, and the concentrate assays from 100 to 150 oz. of silver. No lead-zinc separation is made, owing to the intimate association of lead and zinc in that district.

The Mendota mill is being run by the Wasatch-Colorado Mining & Milling Co., treating 50 tons per day by jigs and tables. The company produces a lower-grade product than the East Butte. Concentrates run from 20 to 30 oz. of silver, 40 per cent lead, and less than 10 per cent zinc. Operations are unprofitable.

The Capital mill, near Georgetown, is being remodeled.

Ed. Chamberlain has taken over the old Stevens mine, above Greymont. This is an interesting old mine and still contains lead-zinc-silver ore of importance. Chamberlain also has the Sunburst-Scepter group.

The Empress company, near Empire, will make a fresh start in its modern mill, equipped with Ruth machinery. This equipment is becoming popular in the county.

The Freeland Development Co., under the management of W. L. Shaffer, is remodeling its mill near Dumont, and will operate this summer.

The famous Gem mine is still tied up by litigation after extensive operations in 1921 and 1922.

The Lombard, at Alice, on Yankee Hill, is under bond and lease to the Tonopah Mining Co. Development is under way.

The Little Mattie has been re-equipped, and operations are in progress.

The Crown Point has been taken over by Frank Heylig and his Kansas associates. They are developing, having installed an electric hoist.

The Golden Age, a part of the Sun & Moon group, has been taken over by O. Longacre, Jr., of New York, who is developing it.

The Quartz Hill Mining Co., under Frank Sparks, is raising from a drift in the Newhouse Tunnel to the old workings of the Kansas-Burroughs group. This is an important development.

The Fairfield, in Russell Gulch, is shipping ore carrying 10 to 12 oz. per ton. It also produces bismuth ore.

The Sampler, at Idaho Springs, is handling about 200 tons of ore per month.

International Increases Converter Capacity at Miami Smelter

The International Smelting Co. is completing at its Miami plant in Arizona the installation of a large converter of the Peirce-Smith type. Although there are five 12-ft. converters, of the Anaconda type in use at the plant, more capacity is needed. The output of this smelter has been about 18,000,000 lb. per month, being first among the reduction plants of Arizona, and handling all the production of the Globe-Miami district, with the exception of direct smelting ore treated at the Old Dominion company's plant. A twenty-acre quarry site that will make available an adequate supply of limestone was recently acquired by the company.

Comstock Merger Mines Co. Acquires Additional Rights

The Savage, Gould & Curry, and Chollar mining companies of Virginia City, Nev., have disposed of their mining rights on the Comstock Lode from the 1,000 to the 1,640, or Sutro tunnel, level, to the Comstock Merger Mines Co., Inc. Previously their mining rights above the 1,000 level were sold to the same company. The mining companies first named retain their rights to all ground below the Sutro tunnel level, and all apex rights as well. The new company is now employing 200 or more men and is sampling and developing the upper levels of the property. The Savage, Gould & Curry, and Bullion companies are jointly engaged in exploring the Garfield lode at the Sutro tunnel level.

Shoot of Rich Lead Ore in West Toledo Mine

Promises New Producer for Alta, Old Camp in Utah—Ore in Limestone

The West Toledo strike has been of considerable interest and speculation, in view of the prospect of a new producer for the camp at Alta, Utah. A report by M. M. Johnson, a Salt Lake engineer, chosen by the Securities Commission and the mine owners, who sampled the 85 ft. opened, at regular intervals, places the gross value of the metal in the deposit, as opened, at $234,877. Mr. Johnson divided the orebody, which as far as could be observed had a thickness of 12 ft., into three sections. Ten feet of the deposit averaged 4.2 per cent lead and 1 oz. silver; 15 ft., 23 per cent lead and 1 oz. silver; and 60 ft., 41 per cent lead and 2 oz. silver. The estimated gross value was calculated on a basis of $8.25 per hundred pounds of lead (silver not considered). No attempt was made to estimate the value of possible future ore, although indications make it probable that ore continues both above and below the level of discovery. The ore occurs as a bedded deposit in the limestone in connection with fissuring. The report holds conditions to warrant the expenditure of further money for development.

Anaconda Bonds Copper Properties in British Columbia

Montana Corporation Takes Over Marble Bay and Adjacent Mines—Once Shippers

BY ROBERT DUNN

The Anaconda Copper Mining Co. has secured an option on the Marble Bay mine, on Texada Island, in British Columbia. The intention is to unwater it immediately, preparatory to proceeding with development. It is authoritatively stated that the same company is negotiating to obtain control of the Van Anda Gold Copper Mining Co.'s holdings. These are situated adjacent to the Marble Bay mine and include the Copper Queen, Cornell, Little Billie, and Security.

With the resumption of operations there will be a revival of mining on the island, where industry has been dormant since early in 1921, when work ceased. Up to that time since 1898 the Marble Bay mine had been a regular producer of copper-gold-silver ore, the copper being chiefly of the bornite variety. Previous to the closing down of the mine, a body of ore was discovered by diamond drilling below the 1,700 level, or about 1,600 ft. vertically below sea level. The management had made arrangements to extend the incline winze already sunk below the 1,600 level from near the face of the northwesterly drift on the 1,500 level to the new discovery, but the price of copper remained too low to warrant the extension of the workings at that time. This, it is understood, is what the Anaconda Copper company purposes doing.

The ore is a mixture of bornite and chalcopyrite in a felsitic gangue. High-grade bornite ore was taken from the lowest level, although it was thought in the earliest stages of development that it would give place to chalcopyrite. A government report says that the ore is found in a light-colored felsite. There is little to guide the management in prospecting for new orebodies, as all the felsite shoots do not contain ore. A little ore may show up in a drift and may open out into a large and profitable oreshoot, while, again, a good showing may be blown out in a few shots.

Wright-Hargreaves Will Double Mill Capacity at Kirkland

Directors of the Wright-Hargreaves mine, in the Kirkland Lake district of Ontario, announce that they have decided to proceed immediately with additional mill construction, which will double the capacity, and will give an output of between 400 and 500 tons a day. This action has been approved by the shareholders at the annual meeting. The recent developments at the mine have been encouraging, and the work at the 1,000 level confirms the values in the upper levels. It is expected that the enlarged mill will be in operation next fall.

Marked Increase in Mining Industry of Colorado

Silver, Zinc and Tungsten Operations Expand—Leadville Uses More Power

A review of the first quarter of 1923 shows a marked increase in Colorado mining as compared with a like period last year. The Colorado Power Co. announces a 25 per cent increase in power consumption by the mines contributary to its lines. The report of this company for February, for the Leadville district, showed that the company was carrying 1,125 more horsepower than for the same period last year.

Officials of the American Smelting & Refining Co. say that purchases of silver ores are 100,000 oz. per month higher than one year ago. Zinc properties in San Juan County, Summit, and Eagle, which were inactive one year ago, are now operating almost to capacity. The tungsten mines in Boulder County which closed down in 1918 are resuming operations, and as soon as weather conditions permit will be operating on a pre-war scale.

Construction work on the 300-ton mill and tramway of the Rawley mines, in Saguache County, is nearing completion, and a large force of miners will be put to work breaking ore as soon as they can be recruited. The new zinc sulphating plant of the American Smelting & Refining Co. at Durango will be completed in May, and 100 additional miners are being added to the Black Bear force to break ore for the new plant.

In practically every mining district in the state one or more important new mining enterprises are being started, and it is estimated that Colorado's mineral output for 1923 will be more than 50 per cent greater than the preceding year.

Iron-Ore Price Advanced 50c. Per Ton for 1923

Iron-ore prices for Michigan and Minnesota ranges have been increased 50c. per ton over last year. They are approximately the same as in 1921. It is reported that the Cleveland-Cliffs company sold 1,000,000 tons at this figure recently and that several other sales of importance have already been made.

The price of ore is based on the iron content, moisture, and phosphorus content, with other conditions average. This makes a large number of basic prices, as ore varies greatly in the different mines. A composite of all the ore prices quoted gives the price at Lake Erie ports, averaged together, $5.42. Deducting $1.84 a ton for freight, $3.48 a ton is the selling price loaded on cars at the mine. Out of this price must come all the costs of mining, such as labor, timber, fuel, powder, other supplies, royalty, taxes, insurance, depreciation and development before profit can be recorded.

Hydroplane, One-Ton Capacity, Will Solve Mine Transportation Problem

Spider Group, in British Columbia, to Be Developed by Belgian Syndicate —Handicapped by Inaccessibility

Theodore Collart, Belgian Consul at Prince Rupert, B. C., has bonded the Spider group of claims, situated five miles north of the Premier mine. Associated with Mr. Collart are a number of Belgians, who also are interested in the Jualin-Alaska Mines Co., which is operating a mine at Juneau, Alaska. A company is to be formed at once, and development of the property will be started as soon as weather conditions permit. A large amount of exploration, including a 500-ft. adit and much trenching and surface stripping, was done on this property in 1920 by the Algunican Development Co., a Belgian concern, which for a time had more than 120 men employed, but the high cost of supplies and labor at that time, together with the heavy discount in converting Belgian into Canadian currency, caused the collapse of the company, leaving a considerable debt for labor and haulage against the property—a debt that has been the means of tying up the property until now. The new concern has arranged for the settlement of this debt without further delay.

The property is one of considerable promise. The 500-ft. adit is said to be in milling ore for the full distance, and oreshoots assaying from 80 to 140 oz. in silver have been opened at the surface. The property is situated on Long Lake, near the summit of the range of mountains between Bear and Salmon rivers, and one of the main difficulties the Algunican company found was that of getting supplies to the property. This difficulty the new concern purposes to overcome by the use of a hydroplane, capable of hauling one ton per trip. The plane will alight on the Portland Canal at one end and on Long Lake at the other. Later, of course, a rope tramway will be necessary, for transporting ore and concentrate.

Mother Lode Coalition Production Increased in March

The Mother Lode Coalition Mines Co., in Alaska, produced during March 1,018 tons of high-grade ore, assaying 61.76 per cent copper, yielding 1,244,725 lb. of copper on 99 per cent extraction basis; and 12,092 tons of milling ore, assaying 6.83 per cent copper, yielding 1,331,494 lb. copper on 80.62 per cent extraction basis. This made total net production of 2,576,219 lb. of copper for the month.

Production for February was 375 dry tons of high-grade ore, assaying 62.64 per cent copper, yielding 464,710 lb. of copper; and 11,644 dry tons of milling ore, assaying 8.48 per cent copper, yielding 1,676,086 lb. copper, making February net production 2,109,144 lb.

Training Schools Established to Help Relieve Labor Shortage

Arizona Companies Find Plan Effective —Objection Is That "Graduates" Are Likely to Emigrate

The shortage of skilled miners is a problem that is being given serious consideration by Arizona producers. The output of some larger mines is limited by the scarcity of men, and the resumption of operation by some of the properties that were the most recent to resume has been hampered. One solution that is being given a trial is the establishment of training schools by which men desirous of qualifying for the more renumerative jobs are given a course of instruction. Miners and timbermen are being turned out by means of such tutoring, men who are not only trained in the intricacies of the particular jobs, but who are thoroughly instructed in the rules of the company and to whom the dangers of the work have been explained. Such instruction has been given men by companies of Bisbee, Morenci, and Ray districts, and the plan is said to be successful. At the Copper Queen mine, in Bisbee, a section of the mine is reserved for this purpose, and many men are being put through training that prepares them for responsible work. No schooling has been conducted in the Globe-Miami district as yet, where the shortage of miners has been less serious than in some other parts of the state, but the plan is being given consideration. One objection to such procedure, and one that was voiced strenuously recently when a speaker from the Ray district was answering inquiries of operators of the Globe-Miami district, is that a few companies cannot turn out men fast enough to supply the needs of all the mines in the state, and there is no way of keeping men at the mine where they have been trained.

C. P. R. Watches Northwestern Quebec Development

The C. P. R. has a survey party in the Rouyn gold field, of northeastern Quebec, laying out a route, in case it should be decided to extend the line being built from Mattawa, into the district. The railway company is showing a good deal of interest in this new district, and it is understood to have two or three observers there. Several companies and syndicates are sending supplies into Rouyn over the winter roads. R. H. Lyman, of Cobalt, has interested a syndicate of New York and Boston people, and has options on 1,500 acres. Sufficient financing has been arranged to permit of a thorough exploration of the properties. Diamond drilling results on the Cockeram group are understood to be encouraging. The Noranda Mines, Ltd., is doing surface exploration and has installed small plants, one of which will be used to sink a shaft on the Powell vein, and the other, a portable plant, is to be used in connection with trenching operations.

Export Duty on Silver From Bolivia Is Increased

Exported silver from Bolivia has become dutiable at a higher rate through a recent executive order, effective from Feb. 15, 1923, and subject to the sanction of the Bolivia Congress, according to the American Consul at La Paz. The former and new duties both vary according to the London quotation on silver, but there is a large increase in the new rates for the higher silver values, as shown by the comparison in the accompanying table, which shows typical grades.

Provision is made for a system licensing and sampling of all silver ore exports to insure payment of the export duty on the full value of the fine silver content.

Price in London	Former Duty, Bolivianos Per Fine Kilo.	New Duty, Bolivianos Per Fine Kilo.
From 10d. to 15d.	0.40	0.50
From 25d. to 26d.	0.64	1.28
From 31d. to 32d.	0.88	2.65
From 41d. to 42d.	1.36	4.08
From 52d. to 53d.	2.23	6.72
From 58d. to 59d.	2.72	8.15
From 60d. up	Variable	8.20

Note—1 boliviano equals $0.3893 at par; 1 kilo equals 2.2046 lb. avoirdupois.

Tailing From Michigan Copper Mines Sold for Construction Work

A possible market for "amygdaloid" tailing is seen in an order for twenty-five carloads of the stamp sand from a Flint, Mich., firm. Several carloads have been shipped from the tailing deposit at the Franklin mill, in the Michigan copper district, and it is understood it will be used in construction work. Stamp sand also is used as a top dressing for highways. Isle Royale last year disposed of 25,000 tons of tailing.

Formerly large quantities of stamp sand were shipped to Cleveland and other points, where it was manufactured into building brick. Amygdaloid tailing does not respond to flotation treatment and is a total loss unless marketed for these several purposes. Millions of tons of stamp sand are available, and if a widespread market can be developed it will be a source of considerable revenue to the mining companies.

Swedish Mines to Resume Operations

By Cable from Reuters to "Engineering and Mining Journal-Press"

Stockholm, April 2—The iron ore mines of Mossgruvan Idkerberget, which are controlled by the Mellansvenska Gruvfaelten, will soon resume operations.

Mount Lyell Increases Copper Production

By Cable from Reuters to "Engineering and Mining Journal-Press"

Melbourne, April 6—The Mount Lyell Copper Mines, of Tasmania, are engaging additional labor with a view to a larger output. The ore production of North Lyell will soon reach 12,000 tons monthly.

Copper-Wire Mill at Tacoma Would Supply Western Market

The erection of a large wire mill at Tacoma, Wash., is expected to be the outcome of the determination of the Kennecott Copper Corporation to market more of its copper in the profitable market now afforded by the western states as a result of hydro-electric development.

Heretofore producers of copper in the Northwest have enjoyed a high-priced market for a considerable part of their output in the Pacific Coast and intermountain states. When the copper was shipped to the East, it was brought into direct competition with the lower-cost output of other mines. With the expansion of this highly desirable western market, it is believed that the Alaskan producers see an opportunity to share in this business.

News from Washington

By PAUL WOOTON
Special Correspondent

Pittman Act Silver

Text of Decision on Which Is Based Deduction of 10,000,000 Oz. From Total Repurchases—Dated Nov. 29, 1922

ON APRIL 5, the editor of *Engineering and Mining Journal-Press* wired his Washington representative as follows: "I do not understand ruling of Director of Mint that silver used for subsidiary coinage is not to have its equivalent purchased from the producers under the Pittman Act. Section three of the Pittman Act does not seem to yield such interpretation. Will you please confer with Director of Mint regarding this interpretation."

On April 6, the representative forwarded to us the following letter, on which the action of the Director of the Mint, or rather that of the Secretary of the Treasury, was grounded. In sending it, our representative stated: "This is dated Nov. 29, but this is the first copy ever made public. The decision to do so was made by the Secretary today."

"COMPTROLLER GENERAL OF THE UNITED STATES
"WASHINGTON

"November 29, 1922.

"The Honorable the Secretary of the Treasury.

"Sir:

"I have your letter of November 2, 1922, requesting decision as to whether you are authorized to revoke certain allocations of silver made pursuant to the terms of the act of April 23, 1918, 40 Stat., 535, for subsidiary silver coinage.

"The act of April 23, 1918, 40 Stat., 535, generally known as the Pittman Act, is entitled 'An Act to conserve the gold supply of the United States: to permit the settlement in silver of trade balances adverse to the United States: to provide silver for subsidiary coinage and for commercial use: to assist foreign governments at war with the enemies of the United States: and for the above purposes to stabilize the price and encourage the production of silver.'

"Section 1 of the act, among other things, authorized the Secretary of the Treasury from time to time to melt or break up and sell as bullion, at prices not less than $1 per ounce of silver one thousand fine, not in excess of three hundred and fifty million standard silver dollars then or thereafter held in the Treasury of the United States.

"Section 2 of the act provided, among other things, upon every such sale of bullion from time to time, that the Secretary of the Treasury direct the Director of the Mint to purchase in the United States, of the product of mines situated in the United States and of reduction works so located, an amount of silver equal to three hundred and seventy-one and twenty-five hundredths grains of pure silver in respect to every standard silver dollar as melted or broken up and sold as bullion, such purchases to be made at the fixed price of $1 per ounce of silver one thousand fine.

"Section 3 of the act provides, among other things, that the allocation of any silver to the Director of the Mint for subsidiary coinage shall for the purposes of the act, be regarded as a sale or resale.

"Section 4 of the act provides an appropriation to reimburse the Treasurer of the United States for the difference between the nominal or face value of all standard silver dollars so melted or broken up and the value of the silver bullion, at $1 per ounce of silver one thousand fine, resulting from the melting or breaking up of such standard silver dollars.

"In the submission it is stated that an allocation was made on September 7, 1918, for subsidiary coinage, of the silver bullion to be obtained from melting 1,000,000 standard silver dollars. The 1,000,000 standard silver dollars thus allocated produced 772,997.89 fine ounces of silver. The subsidiary silver account was charged therefor at the rate of $1 per fine ounce, total $772,-997.89, and the loss occasioned by the transaction, the difference between the nominal or face value of the 1,000,000 standard silver dollars and the sale price of the ounces of fine silver produced therefrom, $227,002.11, was accounted for as an expenditure chargeable under the appropriation contained in Section 4 of the act.

"On November 28, 1919, an allocation was made of 10,000,000 standard silver dollars (these were coins which had not been in circulation) and on November 6, 1920, an allocation was made of 111,168 standard silver dollars (these were old coins which had been in circulation). Both allocations were made on the basis of $1.29— per fine ounce or the equivalent of the nominal or face value of the dollar. In melting or breaking up the 10,000,000 uncirculated standard silver dollars the legal weight in fine ounces was produced, but in melting or breaking up the 111,168 standard silver dollars, which had been in circulation, the legal weight in fine ounces was not produced, there being a loss of 3,624.26 fine ounces, which loss was attributed to abrasion of the coins due to their circulation. The net fine ounces of silver thus produced were charged to the subsidiary silver account, but the value charged was on the basis of the legal weight of the standard silver dollar at the rate of $1.29— per fine ounce. This constituted an overcharge of the value of 3,624.26 fine ounces at $1.29— per fine ounce, total $4,685.91, against the subsidiary silver account. To adjust this matter the Treasury Department Division will state a settlement charging the loss of $4,685.91, resulting from abrasion, under the appropriation contained in Section 4 of this act and crediting a like amount to the subsidiary silver account, the necessary details, etc., for making the transfer to be furnished by the Treasury Department.

"An allocation for subsidiary coinage of 6,000,000 fine ounces of silver at $1 per fine ounce was made pursuant to letters of the Assistant Secretary of the Treasury of October 18 and December 18, 1920. Pursuant thereto 3,458,246.39 fine ounces and $3,458,246.39 were actually charged to the standard silver account and the balance, 2,541,753.61 fine ounces and $2,541,753.61, was held temporarily in abeyance; that is, the balance was not actually charged out of the standard silver dollar bullion account.

On February 11, 1922, the balance of this allocation, 2,541,753.61 ounces, and $2,541,753.61 not actually charged to the subsidiary silver account, together with 1,800,000 fine ounces and $1,800,000 actually charged to the subsidiary silver account, where revoked. Pursuant thereto 1,800,000 fine ounces and $1,800,000 were credited to the subsidiary silver account and a like amount in fine ounces and dollars was charged to the standard silver dollar bullion account.

"The following is a statement of the allocations, etc.:

Date of Allocation	Standard Silver Dollars Allocated	Net Ounces of Bullion Allocated	Rate per Ounce	Fine Ounces Produced	Value Charged
9/ 7/18	1,000,000	.....	$1.00	772,997.89	$772,997.89
11/28/19	10,000,000	.....	1.29–	.....	.....
11/ 6/20	111,168	.....	1.29–	7,816,732.24	10,111,168.00
10/18/20	.....	.....	.....	.....	.....
12/18/20	.....	1,658,246.39	1.00	1,658,246.39	1,658,246.39
					$12,542,412.28
Loss resulting from melting or breaking up, to be adjusted.....					4,685.91
				10,247,976.52	$12,537,726.37

"The precise questions of the submission are (1) whether you are authorized to revoke the remaining balance of all allocations, 10,247,976.52 fine ounces; if so (2) what amount is properly for credit to the subsidiary silver account, and (3) whether, if the revocation of the balance is authorized, there is authority of law for recoining the bullion thus transferred to the standard silver dollar bullion account. The matters will be considered in the order stated:

"(1) From information received from the office of the Director of the Mint the subsidiary silver account shows a balance of 12,994,786 fine ounces of silver on hand, and in the submission you state:

" 'In these circumstances to carry over 10,000,000 fine ounces of silver bullion in the subsidiary silver account means the carrying in the general fund of the Treasury of a dead asset which has no value for the purpose of making Government payments, with the result that the Treasury is obliged to borrow correspondingly larger amounts to meet its current requirements, at an interest cost ranging from 3½ to 4½ per cent. Assuming for the purposes of illustration an average interest rate on Government borrowings of about 4 per cent and that this amount of silver bullion were held as a dead asset for a period of even two years, the result would be a loss to the Government in interest charges amounting to about $800,000 for the two-year period.

" 'In these circumstances, and in order to avoid this loss in its current operations, the Treasury would like, if possible under the law, to revoke the allocation of the remaining 10,247,976.52 fine ounces of silver and restore this amount of silver bullion to the standard silver dollar account. The effect of this action would be to permit the Treasury to proceed with the coinage of this amount of silver bullion into standard silver dollars, against which silver certificates could be issued and paid out in the ordinary course of Government payments . . .'

"Section 2 of the act provides:

" '. . . Such silver so purchased may be resold for any of the purposes hereinafter specified in section three of this Act, under rules and regulations to be established by the Secretary of the Treasury, and any excess of such silver so purchased over and above the requirements for such purposes, shall be coined into standard silver dollars or held for the purpose of such coinage, and silver certificates shall be issued to the amount of such coinage. The net amount of silver so purchased, after making allowance for all resales, shall not exceed at any one time the amount needed to coin an aggregate number of standard silver dollars equal to the aggregate number of standard silver dollars theretofore melted or broken up and sold as bullion under the provisions of this Act, but such purchases of silver shall continue until the net amount of silver so purchased, after making allowance for all resales, shall be sufficient to coin therefrom an aggregate number of standard silver dollars equal to the aggregate number of standard silver dollars theretofore so melted or broken up and sold as bullion.'

"Nothing appears why the balance of the allocations may not be revoked if the silver allocated for subsidiary coinage is not now needed for that purpose. The revocation of the allocations not alone relieves against the carrying of a dead asset but reduces the quota of silver to be purchased under the act from domestic producers, etc., the act providing that the necessary purchases to reinstate the amount sold be made at the rate of $1 per fine ounce, a figure approximately 50 per cent higher than the present market price.

"(2) The cost value of the reported balance of 12,944,786 fine ounces of silver now in the subsidiary silver account is given as $11,994,224. This cost value, after the credit thereto of the amount of $4,685.91, loss due to abrasion, is $11,994,224 less $4,685.91 or $11,989,538.09. The present balance reflects an average fine ounce value somewhat less than the fine ounce value at which the several allocations were made; hence it will be impracticable in revoking the allocations to transfer back to the dollar account the same value transferred therefrom to the subsidiary silver account. The present average fine ounce value resulted from the acquisition of silver at varying prices and the charging out of such of the silver as was used in subsidiary coinage at the average cost per fine ounce. The transfer pursuant to the revocation of the allocations of 10,247,976.52 fine ounces of silver may be made by crediting the subsidiary silver account with that many fine ounces at the rate of $1 per fine ounce, thus leaving in the account a balance of 2,696,810 fine ounces with a value of $1,741,562.09 equal to an average fine ounce rate of approximately the present market value.

"(3) The matter of the coining into standard silver dollars of such of the bullion purchased under the act and of bullion produced by melting or breaking up standard silver dollars, which was allocated and charged to the subsidiary silver account and which allocations are authorized to be revoked and recharged to the standard silver dollar bullion account, is for administrative consideration. There appears sufficient authority therefor under the act if you conclude that this be done. Respectfully,

"(Signed) J. R. McCarl
"Comptroller General."

The *Journal-Press* questions the policy of "revoking" the allotments of silver to the mint for subsidiary coinage. It believes this policy at the best interpretation a device to save money for the Treasury by substantially repudiating a contract with the silver miners of the United States. On a strict interpretation it is possibly even without adequate legal justification. The *Journal-Press*, as the representative of the mining industry, will investigate this matter further.—EDITOR.

Zinc Ore Will Be Smelted "in Bond"

Plant at Amarillo, Tex., Will Treat Mexican Ores and Deposit Metal in Government Warehouses

It is announced that the zinc smelter which is being built at Amarillo, Tex., by the United States Zinc Co. will receive its ore in bond from Mexico. When the finished product comes from the smelter it will be placed in a government bonded warehouse under an official of the customs department, who will act in the capacity of a customs storekeeper. If the finished product from the smelter is withdrawn from the warehouse and exported within three years, no duty will be collected. A duty will be imposed, however, on the zinc that is sold from the warehouse for consumption in the United States. This tax will be assessed as the zinc is withdrawn much in the same manner as bonded warehouses held liquor in the pre-Volstead days. It is expected that the smelter will be placed in operation in a few weeks. It will use natural gas for fuel.

Afterthought Copper Co. Protests Freight Rates on Matte

The rate on copper matte from Bellavista, Calif., to Tacoma, Wash., has been attacked by the Afterthought Copper Co., of Ingot, Calif. The copper company contends that the existing rate is unreasonable to the extent that it exceeds $8.50 per ton on matte not exceeding $70 per ton in value; $9.35 per ton on matte exceeding $70 in value, but not exceeding $100 per ton in value; and $11.20 per ton on matte exceeding $100, but not exceeding $200 per ton in value.

War Minerals Relief

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commissioner has recommended the following awards: Golconda Mining Co., Grants Pass, Ore., $5,751.58; Philadelphia Tungsten Mining Co., Denver, $7,021.94; Robert P. Sullivan, Callahan, Calif., $240; Anderson Manganese Co., Kansas City, Mo., $2,282.42.

Disallowances were recommended as follows: Keeney and Crane, San Luis Obispo, Calif., commercial importance not established; Stearn, Keeney & Crane, San Luis Obispo, Calif., commercial importance not established; Eagle Mine, Denver, justification for additional award not shown; George Brothers, Cecilville, Calif., stimulation not established; R. T. Kidner, Kansas City, Mo., not within the act.

Rhodesian Gold Output

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, April 7—The output of gold in Rhodesia during February totaled 49.424 oz., as compared with a total of 56,630 oz. reported for the month of January.

News by Mining Districts

By Special Correspondents in the Field

Montreal Letter

Quebec Government Will Facilitate Prospecting in Northeast Territory

BY ALEXANDER GRAY

Montreal, April 7—Numerous selected surface and other assays obtained in northwestern Quebec range from $2 to the spectacular. Within the last week exceptionally rich samples have been taken from the southwestern end of Boischatel, near the boundary of Dasserat Township. They were found in the porphyry. Other results were $40 over 10 ft. On the Kinojevis River samples went from $2 to $29. As these represent different properties in an area 20 miles in extent, their significance is not being ignored.

Having confirmation of further finds in these gold areas, the Quebec government has decided to lend every reasonable assistance in the way of transportation facilities. Provision has been made for the complete survey of four townships. Roads are being made from Micmac on the Transcontinental and other points. From the south, the government will supervise water transportation and complete roads. Before long the country between the Ontario border and the Harricana, a distance of 40 miles or so, will be staked. It is expected there will be two thousand prospectors in the bush as soon as the break-up comes.

The Coniagas and Mining Corporation of Canada are the latest of the Cobalt companies to interest themselves in Rouyn Township.

Holding the Wood Kirkland and Moffatt Hall properties, the Tonopah Mining Co. of Nevada has taken over the King Kirkland. This gives the Tonopah company about the largest acreage held by an individual company in Kirkland Lake district—1,679 acres in all.

The directorate of the newly organized Porcupine Goldfields Development & Finance Corporation of London consists of Lord Brabourne, of the New Consolidated Gold Fields of South Africa; E. Mackay Edgar, of the National Mining Corporation, variously identified with international enterprises; Edward Manville; Forrester Clayton; J. A. Agnew, of National Mining technical committee; F. W. Baker, managing director of National Mining; Walter McDermott, veteran director of Fraser & Chalmers, Mines Selection, National Mining and other groups, and J. Malcolm Maclaren, of the National Mining technical committee. The issued capital at the outset will be £500,000. It is surmised that this influential organization may take over the Rochester Veteran claim, adjoining the Hollinger properties. This is mere surmise; at present British Columbia properties are being given some attention.

London Letter

Union Corporation Realized £284,412 in 1922—Efforts to Revive Dolcoath Tin Mine

BY W. A. DOMAN

London, March 28—The Union Corporation, Ltd., which is mainly interested in mining on the Eastern Rand, but which also has a large holding in San Francisco Mines of Mexico, has now issued its annual report for 1922. It shows a realized profit of £284,412, against £280,362 a year earlier, and a net profit of £242,124, in contrast with £179,517. Dividends amount to 3s. a share, or 24 per cent (the shares have a nominal value of 12s. 6d., as against 16 per cent). Although the Union Corporation has such a large interest in San Francisco Mines, no part of the last years' profit was derived from that holding, and as a greatly increased number of shares was acquired last year, substantial profits are still available for the current year. The corporation has a reserve fund now of £180,000.

As an indication of the improvement in the copper market, the Rio Tinto has declared a final distribution for 1922 of 20s. per share, or 20 per cent, making, with the interim dividend of 10s., 30 per cent for the year, leaving to carry forward £447,981, or about £27,000 more than was brought in. Paris has lately been buying these shares heavily, as is seen by the fact that the yield at existing prices is only 4 per cent—not much for a mining undertaking.

I understand that the Porcupine Gold Fields Development & Finance Corporation, which is being formed jointly by the New Consolidated Gold Fields and the National Mining Corporation, is not yet fixed up as regards actual details. Underwriting is in progress, and it is hoped immediately after Easter to make some announcement as to issuing shares to the public. This is a point around which considerable discussion has centered, for it was at first reported that the two parent companies would hold the shares and would not invite the public to participate. The opposite view seems now to be prevalent.

Some time ago I mentioned the arrangement made by the Trade Facilities Committee of the Board of Trade to assist the Dolcoath mine back to prosperity, to relieve unemployment. The original arrangement was that the government would guarantee a loan of £50,000 if the shareholders would put up £70,000. As shareholders did not come forward with the requisite amount, the government has raised its guarantee to £65,000, the shareholders to find £55,000. The government requires that 40,000 Tehidy Minerals shares shall be deposited as additional security. These Tehidy shares were to

have been distributed to debenture holders as part consideration for giving up their rights. Debenture holders are now to be offered shares instead.

Another Cornish mine that is taking advantage of the improved price of the metal is East Pool & Agar, the directors proposing to raise £25,000 in participating preference shares of 5s. each. The bulk of this money is to develop the new lode intersected by the shaft at a depth of about 1,100 ft., to which I recently referred.

The annual report of the Mysore Gold Mining Co. (India) for 1922 is not altogether an exhilarating document. Although a larger tonnage both of ore and sands was treated, the recovery of gold shows a decrease. The average assay value of ore milled was just over 10 dwt. fine gold and the extraction equaled 98.15 per cent. The profit from gold and silver realizing £600,335 was £186,723, against £207,799 for 1921 and £283,383 for 1920. The dividend for the year is 20 per cent, against 25 per cent for the two preceding years. Reserves of milling ore have fallen from 837,000 to 712,000 tons, and, pending further discoveries, the monthly output is to be lessened slightly, but it is hoped the gold return will not show a proportionate decrease.

Brakpan Mines (East Rand) has acquired some gold-mining claims on Schapenrust at an attractive figure, and, to complete the purchase and to furnish funds for the development program, plans to issue 170,000 new shares at a price of 30s. each in the ratio of one for five.

Johannesburg Letter

New Unified Gold Mine Nearing Exhaustion— Has Paid £500,000 in Dividends

BY JOHN WATSON

Johannesburg, March 6 — The new Unified Gold mine is approaching the end of its career. It started operations in 1898 and has paid over half a million pounds sterling in dividends. Last year it employed on an average 75 whites and 780 natives. Three months' notice was given to employees at the beginning of January; but the mine will continue working so long as profits can be earned. A government committee has been appointed by the Minister of Mines to enquire into the probable closing down of the mine.

A blasting accident occurred at the Modder Deep G. M. on the afternoon of March 2, causing the death of four natives and the injury of four others.

On the local Stock Exchange, there has been somewhat of a falling off in business, due to a decrease in buying orders from London. Prices of gold stocks have kept firm, however. Coronation syndicate shares have been in demand owing partly to a resumption of prospecting on the farm Wilgepoort, near Balfour. West Springs have been largely bought; also Consolidated Diamonds and Nigels, the latter rising from 10s. to 12s. during the week.

San Francisco Letter

Dredge Regulation Would Destroy Industry—Pittsburg-Comstock Starts Work

BY GEORGE J. YOUNG

San Francisco, April 5—Senate Bill No. 454, now before the California Legislature and having for its purpose the regulation of the gold-dredging industry, is similar in purpose to the Kehoe bill, which was defeated in 1913. In 1913, thirty-three companies were operating sixty-five gold dredges on 12,000 acres of land, of which 3,600 acres were classified as agricultural; in 1923, twenty-nine dredges are in operation on 5,732 acres of land, of which 1,394 acres are classified as agricultural. The aggregate of gold dredge production from 1913 to 1921, inclusive, was $69,558,906. The acreage involved is exceedingly small, and no new fields have been discovered in this state, in spite of systematic search for them. The proposition to conserve 1,394 acres. when compared with the large capital investment made by the dredging companies and the large annual outgo for labor and materials, is ridiculous. The gold dredger men contend that it would be impossible to comply with the requirements of the Inman bill, which in effect would not regulate but would in part destroy the industry.

Hydraulic mining has started on the ground of the Pittsburg-Comstock Mines Co. near Dedrick. The company is reported to have spent $40,000 in improvement in ditch line and equipment. The property consists of 1,100 acres of placer ground and is worked by hydraulicking. Four dredges are now in operation on Trinity River, the Estabrook, the Gardella, the Lewiston, and the Trinity. Local reports indicate a greater activity among lode prospectors. The Cady Asbestos property near Yreka has been acquired on a ten-year lease by G. Sousa, who is reported to have stated that men would be put to work and the necessary mining and milling machinery will be installed.

The Kennedy Mining & Milling Co., operating at Jackson, has started to sink its main working shaft below the 4,000 level. The Argonaut mine will begin dewatering its main shaft within five or six days, as the shaft has been repaired and the collar of the shaft has been fireproofed.

NORWAY

American Capital Will Help Aluminum Exploitation

Special Correspondence

Director Kloumann of the Höyangfaldene Norsk Aluminum Co. and Herr S. Bodtker, of the Forenings Bank, which has interests in the undertaking, have returned to Christiania from the United States, where they have been negotiating with an American financial group for the acquisition by the latter of a share in the undertaking. As this involved a revision of some of the concessional conditions, trouble arose owing to the Americans objecting to several of the provisions, and particularly to the request of the local commune for a deposit of 1,000,000 kroner to cover unemployment in the event of a premature shutdown. Such objection is valid enough, as, apart from the fact that, in practice, these deposits are seldom, if ever, returnable, any risk of a stranded staff being left on the hands of the commune is more than covered by the influx of capital into districts that are, as a rule, barren and sparsely populated.

At first the State Department had serious doubts about granting a concession, but, induced probably by pressure from the employees of the company, and the communes, and a demand by the Americans for a decision by Feb. 1, a compromise was effected by the substitution of a surety fund of 200,000 kroner for the fulfillment of the concessional terms. The concession has therefore been granted, subject to agreement as to a minor concession involving a transfer of some parcels of real estate. It is computed that about 50,000,000 kroner has been placed in these undertakings.

The concessional period is until 1950, when the contract between the Americans and the Norwegians lapses; but it may be renewed until 1980 if the contractual parties wish it prolonged. In 1980 the power concession to the Höyangfaldene itself expires. The concession to the aluminum company specifies for 80,000 hp. and a royalty from the company of 20 öre per horsepower. The latter also concedes to the communes, for local purposes, 5 per cent of the total power.

ONTARIO

Goldale and West Dome Develop — Keora Financed—Porcupine Busy

Several companies in the Porcupine district are preparing either to start work or enlarge the scope of their operations. At the Goldale property the shaft is to be sunk from the 500 to the 1,000 level. At 500 ft. good ore was encountered, and one shoot of commercial ore was developed over 200 ft. long. The geological conditions lead the management to believe that a greater length of payable ore will be found at greater depth.

The West Dome Lake expects to begin unwatering the mine within the next two weeks, and as soon as this is completed to sink the shaft to 1,000 ft. A considerable amount of development work has been done on this property, which possesses a small mill. The oreshoots, however, were too short to permit of profitable operations. The company has recently acquired an additional twenty acres of ground from the Ritchie Veteran claim adjoining. New York interests are drilling the Martin claim, which lies about a mile south of the Dome. The shareholders of the Keora have ratified a proposal to increase the capital from $2,000,000 to $3,000,000. Diamond drilling will be financed with the proceeds.

BRITISH COLUMBIA

Parallel Vein Reported in Florence Mine

The recent sale of the Florence mine, near Ainsworth, was ratified by the stockholders at a special meeting on March 29. The Florence mine has been yielding high-grade concentrates, running 75 per cent lead and containing 22 oz. silver to the ton. Crosscutting in the mine has disclosed a parallel vein, which is reported to be the most important strike made yet. The vein encountered was on the lowest level and paralleled the vein on which production has been going on for some time, according to R. W. Lloyd, superintendent. The new vein shows a width of 6 ft. carrying 15 per cent lead.

Mill Ready to Start

The Cork Province Mining Co., near Kaslo, B. C., is assembling a crew preparatory to begin milling operations. Work during the winter has been confined to exploration, the most important project being the sinking of a winze from the 300 level. The winze has attained a depth of 100 ft. below the level, and crosscutting to the vein will begin at once to pick up an oreshoot that appears on the level above. This shoot varies in width from 2 to 30 ft., and ore is reported extending 600 ft. in length. The average value of lead concentrate is 55 per cent lead and 40 oz. silver. The zinc concentrates carry 45 per cent zinc and 7 oz. silver.

Queen Mine Paying, Says Pember

The Yellowstone Mining Co., Ltd., at Salmo, which has taken over the Queen mine, has been operating on a paying basis, according to J. W. Pember, managing director. The Queen mine was shut down in 1916 and was under water until unwatered by the Yellowstone company recently. The mine has been credited with a production of $1,300,000 in gold. It is equipped with a 20-stamp mill and five concentrating tables.

IDAHO

New Wage Scale

The accompanying table shows the wage scale adopted by the mining companies in the Coeur d'Alene region, effective on March 16. The mines are operated under the "open-shop" system, and both underground and surface men work eight-hour shifts. Following is the scale for all employees

Miners	$5.50
Shovelers	5.00
Timbermen	6.00
Timber helpers	5.25
Machinists	6.25
Machinist helpers	5.50
Motormen	5.25
Trainmen	5.00
Main hoistmen	6.25
Small hoistmen	5.75
Pump and compressor men	5.75
Surface laborers	4.75
Ore sorters	4.75
Cagers	5.75
Nippers	5.25
Pipe and trackmen	5.75
Shift bosses	6.75
Blacksmiths	6.25
Blacksmith helpers	5.25
Electricians	5.75
Millmen	5.25
Mill repairmen	6.25
Carpenters	6.25

ALASKA

By E. N. Patty

Kennecott Purchases Ladysmith Copper Mine

The Kennecott Copper Corporation has purchased the Ladysmith Smelting Corporation's copper mine, which is on Latouche Island, in the Prince William Sound district, Alaska, adjacent to the Beatson Bonanza mine. At present there are only three large copper mines operating in Alaska. All of them, the Kennecott, the Beatson Bonanza, and Mother Lode, are controlled by the Kennecott corporation. The Ladysmith mine has been idle for some years.

Hammon Dredge Men En Route to Nome

O. E. Coombs and H. S. Little, of San Francisco, dredge men for the Hammon interests, have been in Fairbanks, Alaska, en route to Nome to prepare for next season's operations.

The Hammon company had two large dredges under construction last winter at Nome and expects to have them ready for operation by July 1. These boats are each equipped with 9 cu.ft. buckets and will operate at the rate of 16 to 24 buckets per minute. An electric power plant of 1,575 hp. has been completed with Diesel engines as the prime movers.

Placer Operations on Quail Creek

Bronon & Olson, pioneer placer miners, are preparing for a busy season on Quail Creek, in the Rampart district. For the last two years they have been running ditches and testing the ground along Quail Creek. They have leased a part of their holdings, but will start hydraulicking on their own account as soon as the water runs. The ground is said to be shallow, running from 4 to 10 ft., and their tests have shown an average of 20c. per foot on the benches and about $1 per foot on the creek.

Tractor Moves Placer Machinery

James Stewart will operate a large drag-line outfit on Caribou Creek near Munson's roadhouse, on the Valdez-Fairbanks highway. The outfit, which includes three flat-car loads of machinery, has just reached Fairbanks. It includes a Holt tractor equipped for snow travel. This tractor is now moving the machinery from Fairbanks to Munson's. It is proving effective.

COLORADO

Power Company Builds Flume

Work on the $200,000 contract for rebuilding the big flume on the Western Colorado Power Co., extending from Ames to the power plant at Ilium, commenced March 15. The company furnishes power for many of the larger mines in southwestern Colorado, as well as for illumination in the larger towns. The flume will require about 2,000,000 ft. of lumber, will be 30,000 ft. in length, and will entail an expenditure of over $200,000.

NEVADA

May 1 Set as Date to Start Simon Mill

Construction work at the Simon Silver-Lead mine is progressing rapidly, and it is hoped that mill operations will be resumed about May 1. Mill changes are practically completed. The new hoist has been moved from the Nevada Wonder mine, and a new headframe is being constructed. On the 400 level the main crosscut to the old shaft workings is making rapid progress, and laterals will be driven to the different orebodies as soon as practicable. Connections will soon be started from the new shaft on other levels.

Mabel Mine Produces

The West End Consolidated Mining Co. is pushing development and stoping at its Mabel mine, 20 miles from Mina, and now that weather conditions will permit, regular shipping will be resumed. A winze is down 25 ft. below the 300 level in ore of good grade, and stoping and development is being done from both the 200 and 300 levels.

Tonopah Belmont Options Property Near Mina

The Tonopah Belmont Development Co. has taken an option on a silver-gold property about twelve miles from Mina and has a crew of men at work driving a crosscut tunnel to cut the vein at a depth of about 100 ft. below the outcrop. This property is said to be a new discovery and shows mill ore across wide widths on the surface.

Hydraulicking Resumed

The Round Mountain Mining Co. has started placer operations on a limited scale, and more giants will be added as water supply increases. There is said to be an abundance of snow in both Jett and Jefferson canyons, from which the company gets its water supply, and a little warmer weather will produce the required water. A prosperous hydraulic season is anticipated for next summer.

The new vein, whose outcrop was uncovered during last winter's hydraulic season, is developing well. A 400-ft. incline shaft has been sunk on the vein and a drift on the 250 level has been in ore for 160 ft. Good values have recently been discovered on surface 150 ft. west of the strike on which the shaft was sunk, and a drift is being started from the shaft on the 110 level to cut the downward extension of the new oreshoot at that depth.

Gypsum Deposit To Be Opened

A new 7-mile spur is being constructed from Gerlach, on the Western Pacific R.R., to the property of the Portland Pacific Cement Co. This company is said to own a large gypsum deposit, and operations being started at the new plant will supply coast trade. The plaster plant at Moundhouse is owned by the same company, but this deposit is nearing exhaustion. Electric power is to be generated by two 800 hp. oil engines.

OREGON

Operations Resumed at Two Gold Hill Mines

Resumption of mining operation of the Pittsburgh-Oregon Mining Co.'s property three miles out from Gold Hill is the most important event in the gold-mining industry in this region since the general closing down at the beginning of the war in 1914. The mill equipment consists of ten stamps and a new Hardinge mill, which is reducing 75 tons of ore daily. The width of the "Big" sylvanite vein on the property averages 14 ft. This is the low-grade ore. High-grade ore is taken from lateral veins running from 3 ft. to 5 ft. in width and contacting with the "Big" vein. A cyanide plant is being erected.

In 1916 tungsten was discovered in this mine, and since that time considerable importance has been attached to the property. The tungsten is found with the gold ore in the form of scheelite. The mineral occurs in small stringers with quartz. The veins carrying the best grade of tungsten have been developed to a small extent.

Another mine to resume in the Gold Hill district is the Millionaire Mining Co.'s property, an old-time producer. The mill is inadequate, but new equipment is to be installed. Just south of the Millionaire is the Gold Ridge Mining Co.'s mine, which has been operating in a small way for the last two years. This property is getting ready for new mill equipment.

ARIZONA

Ore in Dripping Springs Mine

A strike of 10 ft. of ore has been reported at the mine of the Dripping Springs Mines Corporation, which is situated between the Globe and Winklemen districts. Exploration was started at the property last fall by diamond drilling from the floor of the main tunnel. A. T. Copely, superintendent, has announced that the holes will be continued to a depth of at least 600 ft. unless ore is encountered sooner. At the time the tunnel, about three quarters of a mile long, was driven, several veins were encountered, and about thirty cars of ore was shipped that averaged 7 per cent copper.

Tax Suit Involves Large Sum

A suit has been filed against the Big Jim Gold Mining Co., of Oatman, Mohave County, alleging failure of the company to report accurately an equity income and excess profits tax in 1917. The amount involved represents a tax on $270,388.14 and is said to be due from the sale of mining claims. Action to recover the tax has been filed in the Federal Court at Phoenix.

New Shaft in Bisbee District

The Ivanhoe Copper Co., of Warren, has reached a depth of 100 ft. with its new shaft. It is planned to go to a depth 200 ft. before drifting is started. Harry Hendrickson is in charge.

UTAH

Ontario Opens New Shoot of Shipping Ore East of Fault

A strike of shipping ore has been made in the eastern half of the Ontario mine at Park City, beyond the fault which divides the property. Hitherto, the output of this well-known property has come entirely from the western part. The success of operations at the Park-Utah, in the eastern section of the camp of Park City, induced the Ontario to again undertake work in its holdings east of the fault, in spite of the failure to find ore here in the past. Drifts from the 1,100 and 1,300 levels were cleaned out, and advanced, and about a year ago low-grade ore was opened in the lower levels, in the limestone below the quartzite. The more recent find of better-grade ore was made on the 600 level in the overlying quartzite. The ore is stated to carry 67 oz. silver, and has been followed 30 or 40 ft.

Park City Shipments

The week's shipment from the camp was unusually large, amounting to 6,478 tons, compared with 5,468 tons the week preceding. The Ontario increased its output over that of the week preceding by 178 tons, and the Keystone brought its output up to 50 or 60 tons daily. Shippers were: Silver King Coalition, 2,210 tons; Park-Utah, 2,181; Park City Mining & Smelting, 1,144; Ontario, 578; Keystone, 365.

Utah Apex Acquires Additional Ground

The Utah-Apex Mining Co. is reported to have purchased the Quinn group of claims of twenty-four acres adjoining its property at Bingham, Utah, on the southeast. The new ground is promising: it is traversed by the Parnell fissure, one of the ore-bearing fissures of the section, and although little developed, shipments of copper ore, chiefly during the period of the war, have been made from the property.

JOPLIN-MIAMI DISTRICT

Missouri Section of Field Awakes

Considerable mining activity is to be noted in the Missouri section of this field, in which there has been virtually no mining since 1918. The Denver Mining Co. is about to begin the erection of a small mill on the Leonard tract, in Leadville Hollow, which adjoins the tract of the Joe Bob Mining Co., which recently completed and started in operation a mill on its lease. Peter Vancil is manager for the Denver Co.

The Hill Top Mining Co., headed by Ben Whitty, has recently developed a queer formation that seems to be zinc oxide, associated with silicate of zinc. Veteran assayers say it is the first ore of the sort they have ever examined here. The deposit is on the Creller land, which is a short distance southwest of Joplin.

Hunter and associates are building a small mill at Central City, about five miles southwest of Joplin, on a lease of the Eagle-Picher Lead Co.'s land.

Homer Powers and associates have developed a promising property on the Luke land, about five miles northeast of Joplin.

Quapaw Company Buys Plant

The Quapaw Mining Co., representing the Charles M. Schwab interest in this field, has purchased the Wolverine mill, west of Quapaw, Okla., the purchase price being reported at $70,000. It is understood here that the Schwab interests are planning to purchase several mills, although actual unwatering of the 2,200 acres under lease has not yet been begun. It is believed this operation will represent an expenditure of not far from $350,000.

MICHIGAN

Calumet & Hecla Looks for Continued High Yield of Copper

By M. W. Youngs

Conditions are favorable to a continuance of the high copper yield per ton of rock treated by Calumet & Hecla. The conglomerate vein at great depth is rich and uniformly mineralized, pillars and old stopes are yielding high-grade rock, and regrinding and flotation are adding several pounds per ton to the total. The 1922 yield of 47 lb. per ton should be maintained in 1923. An extensive tonnage remains to be removed in the conglomerate shafts from the 81st level upward, and it will take ten years or more to exhaust this ground. Mining of the lode at depth will continue from the 81st level haulageway, and, judging from the continued richness of the vein, this work can go on indefinitely. Sinking has been discontinued in No. 7 shaft, Hecla, but drifts on the 83d level are opening ground that averages well with that in upper levels.

The reclamation plant of Calumet & Hecla should do better this year. Throughout the summer the dredge will operate on conglomerate sands deposited farther out in Torch Lake. The tailing was from rock treated in the early days of the property, when losses were comparatively heavy, and assays, better than 14 lb. to the ton. During the winter the dredge operates closer inshore, owing to ice conditions, scooping up sand deposited in later years and containing less copper than the outlying tailing.

The Tamarack reclamation plant, which will go into operation in the spring of 1924, should add approximately 800,000 lb. of refined copper per month to Calumet & Hecla production. Tamarack tailing assays an average of 2 lb. less per ton than that of C. & H., and the capacity of the Tamarack plant will be a little more than half that of the Calumet. The greater part of the machinery and tank equipment of the Tamarack plant will be installed this summer, work on the buildings being about completed.

THE MARKET REPORT

Daily Prices of Metals

Apr.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
5	16.75@17.00	44.50	46.50	8.25	8.175	7.45@7.50
6	16.75@17.00	44.875	46.875	8.25	8.175	7.25@7.45
7	16.75@17.00	44.75	46.75	8.25	8.175	7.20@7.35
9	16 75@17.00	44.50	46.50	8.25	8.175	7.25@7.40
10	16.75@16.875	44.625	46.625	8.25	8.175	7.35@7.45
11	16.75@16.875	45.75	47.625	8.25	8.175	7.375@7.50

*These prices correspond to the following quotations for copper delivered: April 5th to 9th inc., 17.00@17.25c.; 10th and 11th 17.00@17.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin quotations are for prompt deliveries. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
5	74¾	75½	82¾	212½	213¼	28½	28¼	35⅝	35⅝
6	74¼	75	82½	214½	215¼	28⅜	28⅛	35⅛	35⅛
9	73¼	74	82	213⅞	214¾	27⅞	27¾	33⅞	33⅞
10	73¾	74¼	82	215	215¾	27¾	27⅝	35	35
11	73½	74⅜	81¾	218¾	219½	27⅝	27⅝	35⅝	35⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver			Apr.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
5	4.66⅝	99⅝	66¾	32¼	9	4.66⅜	99⅜	66¼	32 1/16
6	4.66½	99⅜	66⅜	32 1/16	10	4.64½	99⅜	65¼	31 11/16
7	4.66½	99⅜	66½	32 3/16	11	4.66	99⅜	65⅝	31 13/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, April 11, 1923

Sales of all of the metals have been in small volume throughout the week, though prices have, in general, held steady. Though some metal prices are high, there is no inflation, for stocks, both in producers' and consumers' hands, are at a minimum. The metal that is being bought is used soon after delivery, and there is little metal in speculative hands.

Copper

Buyers continue off the market in an endeavor to break the price below the level which producers are maintaining with no inconsiderable success so far. Most of these producers are holding at either the 17⅜ or 17.25c. delivered level, but are doing little business. They maintain that the amount of copper available for sale by second-hands who are cutting prices is small, and that should any buying of importance develop it would soon be cleaned up. This is no doubt true, but the fact remains that plenty of copper is offered at 17@17⅛c. delivered to take care of the meager demand. Deliveries over the second half of the year are obtainable at slight concessions under the prices asked for April, May and June, but few interests are willing to sell so far forward. Some big consumers are taking advantage of the opportunity to provide for their future requirements.

Export demand continues unusually quiet.

Consumption in this country continues wonderfully good, deliveries in March being greater than any month in history, not excepting the war period. Here and there are rumors of a slight let-up in activity in the electrical industry, but any such tendency is certainly as yet unimportant.

Lead

The official contract price of lead by the American Smelting & Refining Co. continues at 8.25c., New York.

In the last three days, sales of lead in the New York market have been few and far between. Thursday, Friday, and Saturday a fair business was done at the 8.25c. figure for April-May deliveries, but with the decline in London on Monday and succeeding days, buyers are holding off to see if a break in price will not develop. Foreign lead from two sources is likely to press on the New York market, with London prices below parity. Mexican lead could no doubt be obtained here at 8.20c. and possibly lower if consumers were willing to wait for May-June delivery. Also, Spanish lead is available at 8.175 @8.20c., c.i.f., duty paid. A small tonnage was sold last week at the higher figure. About 1,100 tons of this Spanish lead arrived a few days ago, and more is reported on the way. A lighterage charge of about $1 per ton must be paid by the purchaser, but this lead is of excellent grade, the Penarroya product being exceptionally pure and of good corroding quality, a grade which usually commands a 10-point premium in this country. The pigs are said to be somewhat longer and flatter than consumers in this country are used to handling.

The St. Louis market has been quiet, with most of the sales for small quantities and for April delivery or shipment, consumers preferring to postpone orders for May requirements as long as possible in the hope of a further weakening of the market. Practically all of the business was placed at between 8.15 and 8.20c., with offers of May lead yesterday and today at the lower figure. Desilverized lead in Chicago commanded 8.25c. early in the week, but by yesterday could be obtained at 8.20c.

Zinc

Galvanizers continue only as interested observers of the market. The sudden decline in the London quotations on Monday had a depressing effect on this side, but it proved to be short-lived,

prices reacting to 7.45c. for prompt zinc, St. Louis, on Tuesday. Forward deliveries continue to be quoted at discounts from prompt, but there is less discrepancy in the prices than formerly, June hardly being obtainable at less than 7⅝c. today. Consumption continues excellent. Statistics released by the American Zinc Institute for publication on Saturday, April 14, give the stock on hand March 1 as 10,864 tons; produced in March, 48,731; shipped, 49,574; stock on hand March 31, 10,021 tons. Shipped from plant for export during March, 3,092. Number of retorts operating March 31, 89,054.

Brass special is selling in the East at 8.25c. and high-grade zinc at 8.875@9c., delivered.

Tin

The price of tin seems to have taken a turn for the better, being well above 47c. for Straits today. This has stimulated the interest of dealers, but consumers are still holding aloof. For some time the price of Straits here ruled below the import cost, probably owing to the desire of dealers to influence London quotations downward. There was little danger of selling much tin in the effort. With the increased demand the last day or two, these dealers seem to have withdrawn their cheap offerings. The 99 per cent grade now is selling at a full 2c. discount from the price of Straits, owing to Chinese offerings. Forward tin commands the same price as spot.

Arrivals of tin, in long tons: April 4th, Liverpool, 175; 5th, Marseilles, 50; 6th, China, 90; Straits, 110; 9th, London, 100; Straits, 600; China, 140; 10th, London, 50; total so far in April, 2,455.

Gold

Gold in London: April 5th, 88s. 3d.; 6th, 88s. 3d.; 9th, 88s. 3d.; 10th, 88s. 10d.; 11th, 88s. 6d.

Foreign Exchange

On April 10, cable quotations on francs were 6.5925c.; lire, 4.965c.; marks, 0.00475c.; and Canadian dollars, 1 31/32 per cent discount.

Silver

Sales by the Continent, China, and the Indian bazaars during the last week have forced silver prices down. The bazaars have made some small purchases, but selling predominated and the market showed an easy tendency. The weakness in sterling exchange further accentuated this condition so far as local prices are concerned.

Mexican Dollars—April 5th, 51; 6th, 50⅝; 7th, 50¾; 9th, 50⅝; 10th, 49⅝; 11th, 50⅛.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—General market for 99 per cent grade, 27c. per lb.; 98 per cent, 26c. London quotations, £100@£110.

Antimony — Chinese and Japanese brands, 8⅜c. W.C.C., 9c. Cookson's "C" grade, spot, 10½c. Chinese needle antimony, lump, nominal, 6c. per lb. Standard powdered needle antimony, 200 mesh, at 6½@7c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 8¼@9c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1.10 per lb. London, 5s. 3d.

Iridium—$260@$275 per oz.

Nickel—28@30c. per lb. for 99 per cent virgin metal. London, £125@£130 per long ton.

Monel Metal—Shot and blocks, 32c. per lb.; ingots, 38c.; f.o.b. W. Va.

Palladium—$79 per oz.

Platinum—$118 per oz. London, £22.

Quicksilver—$70 per 75-lb. flask. San Francisco wires $70.85. London £12 5s.

The prices of Cobalt, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, and Thallium are unchanged from prices given April 7.

Metallic Ores

Chrome Ore—Indian chrome ore, $20.50 per ton, c.i.f. Atlantic ports. New Caledonian, $24@$26 per ton. Rhodesian, $20@$22.

Manganese Ore—40@45c. per long ton unit, seaport, plus duty.

Molybdenum Ore—75@85c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates.

Tungsten Ore — Wolframite, $8@$8.50; scheelite, $8.50@$9 per unit of WO_3, f.o.b. New York.

Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and Zircon Ore are unchanged from the quotations published April 7.

Zinc and Lead Ore Markets

Joplin, Mo., April 7—Zinc blende, per ton, high, $51.60; basis 60 per cent zinc, premium, $46.50; Prime Western, $45; fines and slimes, $44@$40; average settling price, all blende, $45.33; calamine, basis 40 per cent zinc, $26@$28; average, $28.60 per ton.

Lead, high, $119.80; basis 80 per cent lead, $115; average settling price all grades of lead, $116 per ton.

Shipments for the week: Blende, 14,865; calamine, 100; lead, 1,902 tons. Value, all ores the week, $897,190.

Only 10,310 tons of zinc was purchased this week, a drop from 28,000 for the week when the basic price was $3.50 per ton higher than it is now. Some agencies continue to purchase approximately the same tonnage each week, the decline in buying being confined to a fourth of those in the market.

Platteville, Wis., April 7 — Blende, basis 60 per cent zinc, $49 per ton. Lead, basis 80 per cent lead, $115 per ton. Shipments for the week: Blende, 284 tons; lead, 35 tons. Shipments for the year: Blende, 8,911; lead, 180 tons. Shipments for the week to separating plants, 553 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $500; No. 2, $250@$325; **long spinning fibers, $135@**$200; **magnesia and compressed sheet** fiber, $100@$150; **shingle stock $65@**$85; paper stock, $35@$42; cement stock, $20@$25; shorts, $9@$14—all per short ton, f.o.b. mines, Quebec, Canada.

Rhodesian No. 1 crude, $375; No. 2, **$250; inferior grade, $200—all c.i.f. Atlantic ports per short ton.**

Bauxite, Barytes, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and **Tripoli** are unchanged from the April 7 prices.

Mineral Products

Arsenious Oxide (white arsenic)—14@15c. per lb. for prompt, nominal. June, 12½c. Second half 1923, 11c.

Potassium Sulphate, Sodium Nitrate, Sodium Sulphate, and **Copper Sulphate** are unchanged from quotations of April 7.

Ferro-Alloys

Ferromanganese — Domestic, 78@8per cent, $120 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $40, f.o.b. furnace; 16@19 per cent, $39.

Ferrocerium, Ferrochrome, Ferrmolybdenum, **Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium,** and **Ferrovanadium** are unchanged from the prices published April 7.

Metal Products

Copper Sheets—Base price 25½c. per lb. Wire, 19⅝c.

Lead Sheets—Full, $10.25; cut, $10.50 per 100 lb.

Zinc Sheets—Base price, $10 per 100 lb., East St. Louis.

Nickel Silver and **Yellow Metal** are unchanged from prices given in the April 7 issue.

Refractories

Bauxite Brick, Chrome Brick, Chrom Cement, **Magnesite Brick, Magnesit**Cement, **Silica Brick** and **Zirkite ar**unchanged from the April 7 prices.

The Iron Trade

Pittsburgh, April 10, 1923

A general wage advance of about 10 per cent will be made in the iron and steel industry effective Monday, April 16. As usual, the lead was taken by the Steel Corporation. The common labor rate advanced from 30c. to 36c. Sept. 1, 1922, and now advances to 40c. The record high was the 46c. rate of Feb. 1, 1920. The highest pre-war rate was the 19c. rate made by the advance of Feb. 1, 1913.

Production of both pig iron and steel has broken the best previous record and bids fair to continue heavy.

Pig Iron—Bessemer, basic, foundry, and malleable remain at $31, Valley. Inquiry is light, with furnaces well sold through the quarter and consumers apparently well covered.

Connellsville Coke—Spot furnace is easy at $6.50@$7, consumers being well served by contracts, chiefly at $7 and $7.25. Foundry is easier at $8@$8.50.

COMPANY REPORTS

Calumet & Hecla Mining Co.

Copper; Michigan

A report of the operations of the Calumet & Hecla Mining Co. for 1922 shows a loss of $937,760.85 for the year according to the following earnings statement:

Received for copper sold	57,549,859 lb. at 13.68c. per lb.		$7,874,156.38
Cost of copper sold			
Production cost at 15.02c. per lb.	$8,644,958.88		
Selling and delivery cost at .50c. per lb.	285,015.56	15.52c. per lb.	8,929,974.44
Loss on copper sold		1.84c. per lb.	$1,055,818.06
Loss by reduction to market value			67,766.55
			$1,123,584.61
Maintenance costs (Jan. 1 to March 31)			
Mine		$377,248.65	
Boston office and mine and corporation taxes		125,002.94	
Depreciation		76,917.09	579,168.68
			$1,702,753.29
Miscellaneous receipts			
Dividends from other companies	$425,312.30		
Interest	228,146.96		
Custom smelting and refining	172,116.10		
Gain from sale C.E.A. Notes, Lowbell Co. sale,	173,384.65	$998,960.01	
Miscellaneous expenses			
Examinations and depreciation		233,967.57	764,992.44
Loss for year			$937,760.85

Changes in net current assets are given as follows:

(a) Balance of current assets Jan. 1, 1922			$12,902,815.62
Loss for year		$937,760.85	
Less depreciation and depletion reserves		2,501,123.63	
		$1,563,362.78	
Capital assets increased			
Plant—new construction	$220,377.58		
Less sale	$604.80		
Less sustained depletion	242.98	361.82	
Stumpage and timber lands		$2,323.53	
Copper Canyon Mining Co.		2,300.00	
Copper mines information		6.54	
Capital assets decreased; stamp mill patents	$4,922.22	$224,645.83	
Mutual W. L. & P. Co. stock	563.83	$5,486.05	
		$219,159.78	
Dividends paid		$1,000,000.00	1,219,159.78
Net increase in current assets			$344,203.00
Balance of current assets Dec. 31, 1922			$13,247,018.62

(a) Increased through $568,657.82 over 1921 by federal adjustments.

Production costs are itemized as follows:

		Per Lb.	
Mining		7.42c.	$3,005,614.78
Smelting and refining		1.40c.	567,919.34
Boston office, mine and corporation taxes		.93c.	378,079.50
Depreciation and depletion		6.00c.	2,424,206.54
Production cost of	40,493,300 lb. at	15.75c.	$6,375,820.16
On hand Jan. 1, 1922	23,864,191 lb. at	14.00c.	3,340,986.74
	64,357,191 lb. at		$9,716,806.90
Sold in year	57,549,859 lb. at		8,644,958.88
	6,807,332 lb. at	15.75c.	$1,071,848.02
Less to reduce to market value			67,766.55
On hand Dec. 31, 1922	6,807,332 lb. at	14.75c.	$1,004,081.47

Bohemia Mining Co.

Copper; Michigan

A report of operations of Bohemia Mining Co. for 1922 states that no exploration work has been undertaken and there have been no new developments affecting the value or prospects of the property. Interest received exceeded all expenditures. Net assets show a gain of $2,937.24.

Isle Royale Copper Co.

Copper; Michigan

A report of the operations of the Isle Royale Copper Co. for 1922 shows a loss of $171,788.21. Copper production for the year (April 1 to Dec. 31) was 6,639,970 lb. Operating accounts follow:

Production Costs

		Cents per Lb.	
Mining		7.61	$505,052.71
Smelting and refining		1.43	94,920.28
Boston office and mine and corporation taxes		1.53	101,680.39
Depreciation and depletion		3.62	240,251.04
Production cost of	6,639,970 lb. at	14.19	$941,904.42
On hand Jan. 1, 1922	4,056,121 lb. at	14.00	567,856.94
	10,696,091 lb.		$1,509,761.36
Sold in year	9,515,111 lb.		1,342,234.96
On hand Dec. 31, 1922,	1,180,980 lb at	14.19	$167,526.40

Earnings Statement

		Cents per Lb.	
Received for copper sold—9,515,111 lb. at		13.67	$1,300,526.85
Cost of copper sold			
Production cost at 14.11c.	$1,342,234.96		
Selling and delivery cost at .49c.	47,066.24 at	14.60	1,389,301.20
Loss on copper sold		.93	$88,744.35
Maintenance costs (January to March)			
Mine	$44,643.80		
Boston office and mine and corporation taxes	33,415.16		
Depreciation	5,069.93		83,128.89
			$171,903.24
Miscellaneous receipts			
Interest	$17,932.16		
Miscellaneous expenses	17,817.13		115.03
Loss for year			$171,788.21

Changes in Net Current Assets

Balance of current assets Jan. 1, 1922			$1,336,557.82
Loss for year	$171,788.21		
Less depreciation and depletion reserves	245,320.97	$73,532.76	
Capital assets			
Plant increased—new construction	$16,847.87		
The Lake Milling, Smelting and Refining Co.—decreased	2,122.62		
	$14,725.25		
Dividends paid	150,000.00	164,725.25	
Net decrease in current assets			91,192.49
Balance of current assets Dec. 31, 1922			$1,245,365.33

Ahmeek Mining Co.

Copper; Michigan

A report of the operations of the Ahmeek Mining Co. for 1922 shows a loss of $151,551.73. Copper production for the year (April 1 to Dec. 31) was 14,885,081 lb. Operating accounts follow:

Production Costs

		Cents per Lb.	
Mining		5.93	$882,754.50
Smelting and refining		1.66	247,523.86
Boston office and mine and corporation taxes		.85	126,348.73
Depreciation and depletion		4.47	665,669.97
Production cost of	14,885,081 lb. at	12.91	$1,922,297.06
On hand Jan. 1, 1922	9,892,100 lb. at	14.00	1,384,894.00
	24,777,181 lb.		$3,307,191.06
Sold in year	21,870,413 lb.		2,931,803.68
On hand Dec. 31, 1922,	2,906,768 lb. at	12.91	$375,387.38

Earnings statement is given in first column of p. 692.

Earnings Statement (Ahmeek Mining Co.)

Received for copper sold	21,870,413 lb.	at 13.66c. per lb.	$2,986,548.98
Cost of copper sold			
Production cost at 13.41c. per lb.	$2,931,803.68		
Selling and delivery cost at .50c. per lb.	108,670.39	at 13.91c. per lb.	3,040,474.07
Loss on copper sold		.25c. per lb.	$53,925.09
Maintenance costs (Jan. 1 to March 31)			
Mine		$91,268.61	
Boston office and mine and corporation taxes		41,463.94	
Depreciation		7,008.44	
			139,740.99
			$193,666.08
Miscellaneous receipts			
Interest		$75,038.63	
Miscellaneous expenses		32,924.28	42,114.35
Loss for year			$151,551.73

Changes in Net Current Assets

Balance of current assets Jan. 1, 1922		$3,079,475.04
Loss for year	$151,551.73	
Less depreciation and depletion reserves	672,678.41	
	$521,126.68	
Capital assets increased		
Plant—new construction	12,326.88	
	$508,799.80	
Dividends paid	400,000.00	
Net increase in current assets		108,799.80
Balance of current assets Dec. 31, 1922		$3,188,274.84

North Butte Mining Co.

Copper; Montana

A report of the operations of the North Butte Mining Co. for 1922 shows a profit of $9,094.28 according to the following account:

Income

Income from copper, silver, and gold		$1,772,003.60

Expenditures

Mining and development	$983,377.66	
Freight on ore	30,711.10	
Concentrating, smelting, freight on bullion, refining and selling expense	619,026.08	
General expenses and taxes	129,794.48	
		1,762,909.32
Net income		$9,094.28

Balance sheet as of Dec. 31, 1922, is given as follows:

Assets

Mining property	$9,184,801.19	
Granite Mountain shaft construction	146,760.15	
East Side property development	495,689.00	
Deferred development	534,332.98	
Investments	3,531.24	
Cash	69,892.43	
Notes receivable	8,000.00	
Accounts receivable	1,948.73	
Supplies at mine	27,695.60	
Copper and silver to company's credit with United Metals Selling Co	885,195.07	
		$11,357,846.39

Liabilities

Capital stock		$6,450,000.00	
Dividends unclaimed		1,033.15	
Accounts payable		39,359.64	
Copper Export Association, Inc		244,562.22	
Advances on metals		119,261.86	
Treatment charges (not due)		132,251.82	
Reserve for ore depletion		3,360,319.69	
Surplus		1,011,058.01	
Balance Jan. 1, 1921	$1,287,095.40		
Profit for year	9,094.28		
	$1,296,189.68		
Less for ore depletion	285,131.67		
			$11,357,846.39

Production

During the year there were shipped 178,080 wet tons of ore and 15.7 wet tons of precipitates, which produced 9,504,389 lb. of fine copper, 308,681.14 oz. of silver, and 568.037 oz. of gold. There was no production during the first five months of the year.

In considering the results of operation it must be remembered that the entire production was made in seven months, which carried twelve months' overhead, and that wages were increased in September 50c. per day. The management has by careful supervision done much to promote operating efficiency and to create satisfactory conditions.

McKinley-Darragh-Savage Mines

Silver; Ontario

A report of the operations of the McKinley-Darragh-Savage Mines Co., of Cobalt, Ltd., for 1922 shows a net profit of $65,086.64, according to the following account:

Sales and production		
Amount of ore reported sold	$115,216.21	
Less cost of marketing	11,241.09	
		$103,975.12
Ore at smelters	$53,535.82	
Less overshipment by Deloro	151.94	
	$53,383.88	
Less estimated cost of marketing	3,839.60	
		49,544.28
Ore at mines		40,559.40
Net value of ore produced		$194,078.80
Bullion in storage Jan. 1, 1922	$206,442.62	
Sold for	224,756.61	
		18,313.99
Net sales and production		$212,392.79
Cost of production		109,357.42
Gross profit on operations		$103,035.37
Deductions		
Administration and shut-down expense		$39,190.20
		$63,845.17
Add interest and exchange received		1,241.47
Total net profit		$65,086.64

Balance sheet as of Dec. 31, 1922, is given as follows:

Assets

Current assets		
Cash in banks and on hand	$126,805.81	
Materials and supplies on hand	18,143.15	
Accounts receivable	2,488.66	
Ore at smelters	51,769.83	
Ore at mines	40,559.40	
		$239,766.85
Deferred charges to operations:		
Unexpired insurance		39.17
		$239,806.02
Capital assets		
Mining properties	$2,106,244.88	
Plant	20,248.17	
Furniture and fixtures	789.05	
		$2,127,282.10
Total assets		$2,367,088.12

Liabilities

Current liabilities		
Accounts payable	$4,840.84	
Accounts payable special	2,296.08	
Reserve for taxes	3,300.00	
		$10,436.92
Capital stock outstanding		2,247,692.00
Total liabilities		$2,258,128.92
Surplus		108,959.20
Total liabilities and surplus		$2,367,088.12

Production amounted to 297,033 oz. of silver, of which 254,307 oz. was shipped. The average price received was 65c. per oz. Cost of production was 54.5c. Silver on hand Jan. 1, 1923, was 64,380 oz., compared with 21,654 on Jan. 1, 1922. Operations were resumed on May 15, 1922.

Tonopah Belmont Development Co.

Silver; Nevada

A condensed statement of the operations of the Tonopah Belmont Development Co. for the quarter ended Dec. 31, 1922, follows:

Received and receivable for ore	$332,389.56
Mining, milling and administration expenses	265,196.47
Net earnings for three months	$67,193.09
Miscellaneous income	6,685.44
Dividend from Belmont Surf Inlet Mines, Ltd	50,000.00
Total net income for three months ended Dec. 31, 1922	$123,878.53

Available Resources, Feb. 28, 1923

Due from smelter	$141,545.30
Due from others	97,979.99
Cash in banks	178,102.57
U. S. Treasury notes	100,000.00
Liberty bonds	50,031.25
	$567,659.11

The net earnings for the quarter ended Dec. 31, 1922, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, were $40,218.28.

Electrification in France to Require Copper

SPECIAL FOREIGN CORRESPONDENCE

No stocks of copper are now being carried in France, smelters and fabricators not being willing to take a chance on the fluctuations of exchange. During the next few years France will be an interesting market for copper and should absorb important quantities of that metal. Electrification of railways is proceeding apace. During the last months of 1922, electrically driven trains were run between Pau and Tarbes, and it is hoped that in 1923 the electrification of that line of the Southern Railroad Company (Midi) will be pushed up as far as Toulouse. Anyway, the 150,000-volt distribution system will be terminated this year.

The line from Paris to Orléans, already electrified as far as Brétigny, will be entirely electrified in 1925, when the two systems of power distribution of 90,000 and 150,000 volts, built in conjunction with the electrification of the line, will also be terminated.

Early in 1926, the line Culoz-Modane, on the P. L. M. system, will also be entirely electrified.

The insufficiency of coal supplies is restricting on this side the production of zinc. There is, however, a good demand, and one of the most important transforming works was looking recently for some raw zinc for rolling purposes. Future prospects are favorable.

A French company with a capital of 1,000,000 francs has been formed for the working of titaniferous ore deposits and for the treatment of the ore—of ilmenite particularly—using the Carteret-Devaux processes. Ferrotitanium for steel works will be produced and special pigments for anti-rust and submarine paints. Negotiations are now being made for the purchase of ilmenite deposits in the Sénégal and in French Indo-China. Later it is proposed to exploit the Carteret-Devaux processes for the manufacture of titanium salts, particularly blanc de titane (white titanium).

Imports of Ores and Metals in December

In Pounds Unless Otherwise Stated

	December, 1921	December, 1922
Antimony		
Ore	.....	.....
Metal, matte and regulus	2,286,638	528,745
Copper and brass		
Ore	7,528,443	3,430,469
Concentrates	4,520,355	6,519,375
Regulus, coarse metal and cement copper	2,795,843	40,466
Total	14,844,641	9,990,310
Imported from:		
Spain	1,073,241	495,360
Canada	233,583	498,410
Mexico	1,017,655	3,657,818
Cuba	2,182,262	2,405,861
Chile	7,483,105	2,441,308
Colombia	2,581	.....
Peru	210,558	462,710
Venezuela	.....	.....
Other countries	2,551,656	28,843
Unrefined black, blister and converter copper in pigs and bars	14,731,185	42,290,296
Imported from		
United Kingdom	3,687,919	3,403,632
Canada	.....	6,247,944
Mexico	1,149,612	9,941,962
Chile	2,052,657	13,946,884
Peru	7,412,239	5,258,565
Portuguese Africa	.....	2,364,520
Other countries	428,758	1,126,789
Refined copper	1,655,414	7,291,828
Old and clippings for remanufacture	784,790	489,562
Composition metal, copper chief value	7,721	1,925
Copper manufactures	.....	8,157
Brass		
Old and clippings for remanufacture	13,123,906	2,889,670
Manufactures of brass	.....	46,881
Lead		
Ore and matte	830,967	3,607,873
Bullion or base bullion	.....	3,766,833
Pigs, bars, other forms and old	467,365	1,444,930
Manufactures of lead (except type metal)	.....	13,820
Type metal (lead content)	.....	.....
Manganese ore, long tons	14,900	.....
Tungsten ore, long tons	.....	142,074
Pyrites, long tons	32,164	60,737
Tin		
Tin ore	1,256,640	2,169,972
Tin in bars, blocks and pigs	8,879,859	16,642,788
Imported from		
United Kingdom	3,179,295	485,831
China	56,000	280,639
British Straits Settlements	5,475,983	11,274,104
Dutch East Indies	.....	2,041,559
Hongkong	.....	2,086,712
Australia	79,520	190,400
Other countries	89,061	283,543
Zinc ore	.....	.....
Zinc in blocks and pigs	131,245	1,113

Facts for the Stockholder

XIII—Granby Consolidated Mining, Smelting & Power Co., Ltd.

THE Granby Consolidated Mining, Smelting & Power Co., Ltd., was incorporated in British Columbia in March, 1901, to acquire and operate the properties of the following: Old Ironsides Mining Co.; Knob Hill Gold Mining Co., Ltd.; Grey Eagle Gold Mining Co., Ltd.; Granby Consolidated Mining & Smelting Co., Ltd., and Grand Forks Water Power & Light Co. In addition, it has acquired the Snowshoe Gold & Copper Mines, Ltd.; the Hidden Creek Copper Co., and a part interest in the Crow's Nest Pass Coal Co., Ltd.

During 1914, the company acquired the Midas mine, near Valdez; the Mamie mine, at Hadley, and the Deans mine, on the Kasaan Peninsula, Prince of Wales Island, Alaska. In 1917, it acquired about 2,000 acres of coal lands near Nanaimo, B. C., with a view to producing its own coal supply. Its coal fields on Vancouver Island contain 7,000,000 tons of coal, and are at present producing over 700 tons per day.

Mining properties include about 1,150 acres of mineral land at Phoenix, B. C., comprising forty-four claims, fifteen of which are known to contain minerals. The chief ore-making minerals are chalcopyrite, hematite, pyrite, and magnetite. The Hidden Creek properties in northwestern British Columbia comprise 412 acres of mineral rights, the Maple Leaf and Bunker mineral claims, and 600 acres of land; also water rights in Falls Creek. The company's smelting plant is situated at Anyox, B. C.

During 1916, 1917, and 1918 production averaged more than 42,000,000 lb. of copper per annum. During the last two years, the production has been at the rate of about 30,000,000 lb. copper per annum. The silver production amounts to about 500,000 oz. annually. Ore reserves are estimated at around 10,000,000 tons, averaging 2.34 per cent copper.

Capitalization consists of 180,004 shares, $100 par value. Authorized capital stock was increased from $20,000,000 to $25,000,000 in February, 1920; and to $50,000,000 in February, 1923. The last increase was designed to cover acquisition of control of the properties of the Canada Copper Corporation, Ltd., through exchange of stock. There are about 1,800 shareholders.

Total funded debt amounts to $3,955,000, consisting of $1,455,000 first-mortgage convertible series "A" 6s, due May 1, 1928, dated May 1, 1913, redeemable at 105 and interest Nov. 1, 1923, or any interest date thereafter upon sixty days' notice, as a whole only, or for sinking fund May 1, 1914, or any May 1 thereafter at 110 and interest, convertible up to and including May 1, 1923, into capital stock at par, with adjustment as to interest and dividend; and $2,500,000 five-year 8 per cent convertible debentures, due May 1, 1925, dated May 1, 1920, redeemable on sixty days' notice at any time up to and including May 1, 1923, at 110 and interest, and after May 1, 1923, at 105 and interest, convertible at any time into stock at the rate of one share of $100 par for $55 principal amount of bonds. The series "A" 6s are secured by a first mortgage on all of the company's property. The 8 per cent convertible debentures are a direct obligation of the company, but are not secured by mortgage.

Earnings per share during the last several years have been as follows: $7.55 in 1913, $2.93 in 1914, $6.19 in 1915, $20.93 in 1916, $33.19 in 1917, $15.72 in 1918. In subsequent years there were losses of $3.85 a share in 1919, $4.58 in 1920, and $1.90 in 1921. During the last year conditions have improved. Net tangible assets applicable to the capital stock at the close of 1921 amounted to about $99 a share.

Dividend record since 1912 is as follows: 1913, 6 per cent; 1914-15, 3; 1916, 7; 1917-18, 10; 1919, 3¾; last payment 1¼, May 1, 1919.

Price range of the stock during the past ten years has been: High, 120 in 1916; low, 15 in 1920 and 1921; closing price, 30, April 10, 1923. INVESTIGATOR.

MINING STOCKS

Week Ended April 7, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	80½	78¾	89	Mar. 23, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2½	2	2½		
Alloues	Boston	26½	26	26	Mar. '19	1.00
Anaconda	New York	50¼	48½	50	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3	2⅝	2⅝		
Ariz. Com'l	Boston	14¼	12½	14	Oct. '18, Q	0.50
Calaveras	N. Y. Curb	3½	3½	3½		
Calumet & Arizona	Boston	61	59½	60¼	Mar. '23,	1.00
Calumet & Hecla	Boston	365	355	358	Mar. '23, Q	7.00
Canada Copper	N. Y. Curb			*4		
Centennial	Boston	11	10	11	Dec. '18, SA	1.00
Cerro de Pasco	New York	49½	47½	48¼	Mar. '21, Q	0.50
Chile Copper	New York	28¼	27½	28	Mar. 23,	0.625
Chino	New York	29	26½	28⅜	Sept. '20, Q	0.37
Copper Range	Boston	44	42¾	43	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1 3/16	1 1/16	1⅛		
Davis-Daly	Boston	4½	3¼	3⅜	Mar. '20, Q	0.25
East Butte	Boston	10	9	9¼	Dec. '19, A	0.50
First National	Boston Curb	*50	*50	*50	Feb. '19, SA	0.15
Franklin	Boston	2½	2	2		
Gadsden Copper	N. Y. Curb	*80	*75	*75		
Granby Consol.	New York	32½	30	31½	May '19, Q	1.25
Greene-Cananea	New York	29	28	28⅛	Nov. '20, Q	0.50
Hancock	Boston	4	3½	3½		
Howe Sound	N. Y. Curb	3¾	3⅜	3⅜	Jan. '21, Q	0.05
Inspiration Consol.	New York	38⅜	37⅜	38½	Apr. '23, Q	0.50
Iron Cap	Boston Curb	8½	8	8½	Sept. '20, K	0.25
Isle Royale	Boston	28¼	27½	28	Mar. '23, Q	0.50
Kennecott	New York	41¾	40½	40¾	Jan. '23, K	0.75
Keweenaw	Boston	1⅜	1⅓	1⅜		
Lake Copper	Boston	4¼	4	4		
Magma Copper	New York	36⅜	35⅛	36⅛	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2⅜	2¼	2⅜		
Mass Consolidated	Boston	3¼	3¼	3½	Nov. '17, Q	1.00
Miami Copper	New York	28¼	27½	27¾	Apr. '23, Q	0.50
Michigan	Boston	2¼	2¼	2¼		
Mohawk	Boston	62	60¾	61½	Mar. '23, Q	1.00
Mother Lode Con.	New York	12½	11⅜	11⅜	Mar. '23, K	0.50
Nevada Consol.	New York	16	14⅜	15¼	Sept. '20, Q	0.25
New Cornelia	Boston	22	20½	21½	Feb. '23, Q	0.25
North Butte	Boston	10½	9½	9¾	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*84	*75	*82		
Old Dominion	Boston	29	26⅞	27½	Dec. '18, Q	1.00
Osceola	Boston	40½	38	40	Mar. '23, K	1.00
Phelps Dodge	Open Mar.	†185	†180		Apr. '23, Q	1.00
Quincy	Boston	45	42	44	Mar. '20, Q	1.00
Ray Consolidated	New York	15½	14⅜	14⅜	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1½	1⅜	1⅜		
St. Mary's Min. Ld.	Boston	48	48	48	Mar. '23, K	3.00
Seneca Copper	Boston	10½	10⅛	10⅛		
Shannon	Boston			*81	Nov. '17, Q	0.25
Shattuck Arizona	New York	9⅜	9⅛	9⅛	Jan. '20, Q	0.25
South Lake	Boston			*50		
Superior & Boston	Boston	2 3/16	2	2 1/16		
Tenn. C. & C. cfs.	New York	11⅛	11	11⅛	May '18, I	1.00
Tuolumne	Boston	*44	*40	*40	May '13,	0.10
United Verde Ex.	N. Y. Curb	37	34½	36	Nov. '22, Q	0.25
Utah Consol.	Boston	2⅜	2⅛	2⅛	Sept. '18,	0.25
Utah Copper	New York	72⅜	70	71½	Mar. '23, Q	1.00
Utah Metal & T.	Boston	1	1	1	Dec. '17,	0.30
Victoria	Boston	1⅜	1⅜	1⅜		
Winona	Boston	1¼	1¼	1¼		
Wolverine	Boston	10	9¼	10		
NICKEL-COPPER						
Internat. Nickel	New York	14¼	14	14⅛	Mar. '19,	0.50
Internat. Nickel, pfd.	New York	77	76½	77	Feb. '23, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	5	4	5		
National Lead	New York	132½	127	131½	Mar. '23, Q	2.00
National Lead, pfd.	New York	111½	111	111	Mar. '23, Q	1.75
St. Joseph Lead	New York	20¼	20½	20⅜	Mar. '23, Q,X	0.50
ZINC						
Am. Z. L. & S.	New York	17½	16	16⅜	May '20,	1.00
Am. Z. L. & S. pfd.	New York	53½	52½	53	Nov. '20, Q	1.50
Butte C. & Z.	New York	10	9½	9½	Mar. '23,	0.50
Butte & Superior	New York	33¾	31½	32	Dec. '22,	0.50
Callahan Zn-Ld	New York	11	9⅝	10¼	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	178½	177	178½	Feb. '23, Q	2.00
United Zinc	N. Y. Curb	*88	*86	*88		
Yellow Pine.	Los Angeles	65	*65	*65	Sept. '20, Q	0.03
SILVER						
Alvarado	N. Y. Curb	6¼	6½	6½		
Batopilas Mining	New York	⅜	¼	⅜	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*52	*51½	*51½	May '20, K	0.03
Candelaria	N. Y. Curb	*25	*20	*20		
Castle-Trethewey	Toronto	*28½	*27	*27		
Coniagas	Toronto	3.25	3.00	3.15	May '21, Q	0.12½
Crown Reserve	Toronto	*62	*61	*61	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	1⅜	1⅛	1⅛		
Kerr Lake	N. Y. Curb	3½	2¾	3	Jan. '23, Q	0.12½
La Rose	Toronto	*30	*29	*29½	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*25½	*25	*25	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	3.48	3.45	3.45	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	5⅞	6	Jan. '23, Q,X	0.60
Ontario Silver	New York	7	6	7	Jan. '19, Q	0.50
Temiskaming	Toronto	*45	*41½	*43½	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York			¼		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Carson Hill	Boston	8⅛	7⅛	7⅛		
Cresson Consol. G.	N. Y. Curb	3	2⅛	2⅛	Apr. '23 Q.	0.10
Dome Mines	New York	42¾	41¼	42¼	Jan. '23, Q	0.50
Golden Cycle	Colo. Springs	1.09	1.08	1.09	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	13.50	13.45	13.45	Mar. '23, M	0.05
Homestake Mining	New York	70	69	69	Mar. '23, M	0.50
Kirkland Lake	Toronto	*62	*61	*61		
Lake Shore	Toronto	3.45	3.42	3.42	Nov. '22, Q	0.02
McIntyre- Porcupine	New York	19⅛	18⅞	19¼	Jan. '23, K	0.25
Portland	Colo. Springs	*32	*32	*32	Oct. '20, Q	0.01
Teck Hughes	N. Y. Curb	1⅛	1 1/16	1 1/16		
Tom Reed	Los Angeles	1.11	*98	1.02½	Dec. '19,	0.02
United Eastern	N. Y. Curb	2½	2	2	Jan. '23, Q	0.15
Vipond Cons.	Toronto	*69	*69	*69		
White Caps Mining	N. Y. Curb	*10	*9	*9		
Wright-Hargreaves	Toronto	3.58	3.55	3.55	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1⅛	*90	1⅛	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*20	*15	*18		
Cons Virginia	San Francisco	18½	11½	14½		
Continental Mines	N. Y. Curb	5½	5	5		
Dolores Esperanza	N. Y. Curb	2	1⅜	1⅜	Jan. '23	2.50
Tonopah Belmont	N. Y. Curb	1⅛	1 1/16	1¼	Apr '23, Q	0.05
Tonopah Divide	N. Y. Curb	*82	*70	*82		
Tonopah Extension	N. Y. Curb	3 1/16	3 1/16	3¼	Jan.' 23, Q,X	0.10
Tonopah Mining	N. Y. Curb	2	1 1/16	1⅛	Jan.' 23, SA	0.15
Unity Gold	N. Y. Curb	5¼	4¾	5¼		
West End Consol.	N. Y. Curb	1 1/16	1 1/16	1⅛	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	17	17	17	Sept. 19, Q	0.25
Caledonia Mng.	N. Y. Curb			*6	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*30	*29½	*29½	Dec. '20,	0.15
Chief Consol.	Boston Curb	4¾	4⅛	4⅛	Feb. '23, Q	0.10
Columbus Rexall	Salt Lake	*27	*24	*27	Aug. '22,	0.03
Consol. M. & S.	Montreal	29	28½	29	Oct. '20, Q	0.62½
Federal M. & S.	New York			10½	Jan. '09,	1.50
Federal M. & S. pfd.	New York	50	47¾	49⅜	Mar '23, Q	1.75
Florence Silver	Spokane	*38	*38	*38	Apr. '19, Q,X	0.01½
Hecla Mining	N. Y. Curb	9⅛	8⅞	9	Mar. '23,	0.25
Iron Blossom Con.	N. Y. Curb	*34	*34	*34	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*13	*10	*13	June '21, I	0.02
Park City	Salt Lake			3.30	Apr. '23,	0.12½
Park Utah	N. Y. Curb	3⅜	3⅜	3⅜	Apr. '23	0.15
Prince Consol.	Salt Lake	*9½	*7½	*9	Nov. '17,	0.02½
Silversmith	Spokane	*45½	*43	*44	Oct. '22,	0.01
Simon Silver Lead	N. Y. Curb	*38	*33	*38		
Tamarack-Custer	Spokane	1.55	1.50	1.55	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.85	2.67½	2.70	Dec. '22, Q,X	0.10
Utah-Apex	Boston	5¼	4⅛	4 1/16	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	67	64½	65½	Apr. '23, Q	1.25
Char. Iron	Detroit			2		
Char. Iron, pfd.	Detroit	3⅜	3⅜	3⅜		
Colorado Fuel & Iron	New York	28¼	27½	27½	May '21	0.75
Col. Fuel & Iron, pfd.	New York			102	Feb. '23, Q	2.00
Gt. North'n Iren Ore	New York	34¾	32½	32⅝	Dec. '22	1.00
Inland Steel	N. Y. Curb			50½	Mar. '23	0.25
Mesabi Iron	N. Y. Curb	10⅜	10⅛	10⅛		
Replogle Steel	New York	27½	26	26½		
Republic I. & S.	New York	64	59⅝	62⅜	May '21	1.50
Republic I. S., pfd.	New York	95½	94	95½	Apr. '23	1.75
Sloss-Sheffield S. & I.	New York	54½	51½	54½	Feb. '21	1.50
Sloss-Shef. S.&I., pfd.	New York	83½	83½	83½	Apr. '23	1.75
U. S. Steel	New York	108½	105⅞	106⅜	Mar. '23, Q	1.25
U. S. Steel, pfd.	New York	118⅜	118	118½	Feb. '23	1.75
Virginia I. C. & C.	New York	62	61	61	Jan. '22	1.50
Virginia I.C.&C.,pfd.	New York			82	Jan '23	2.50
VANADIUM						
Vanadium Corp.	New York	42	39	41	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal			68½	Oct. '22 Q	1.50
Asbestos Corp. pfd.	Montreal	89	88¼	88¾	Oct. '22 Q	1.75
SULPHUR						
Freeport Texas	New York	19⅜	18½	19	Nov. '19, Q	1.00
Texas Gulf	New York	62	60	61	Mar. '23, Q	1.25
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3¼		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	53	51	51½	Mar. '23, Q	0.75
Amer. Metal pfd.	New York	116½	116	116	Mar. '23, Q	1.75
Amer. Sm. & Ref.	New York	65⅛	60⅜	64¼	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	100½	98½	99½	Mar. '23 Q	1.75
U. S. Sm. R. & M.	New York	38	36½	37½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	44½	44¼	44½	Jan. '23 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange, Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—Structural shapes quoted at $2.45@$2.70 per 100 lb., f.o.b. Pittsburgh, against $2.25@$2.40, one month ago. Plates firm at $2.50@$2.75 on new business for prompt delivery. Blue annealed and galvanized steel sheets up 50c. per 100 lb. at mill; black advanced 40c. during month. Mill rises reflected in higher warehouse quotations. Spikes and track bolts higher in Pittsburgh, St. Louis and San Francisco. Cast-iron pipe advanced $2 in New York and St. Louis; $3 in San Francisco and $4 per ton in Chicago, since last month. Drill rod higher in New York, hot pressed and cold punched nuts advanced in Cleveland and Chicago and wire nails up in San Francisco and St. Louis. Yellow pine timbers up $2 in New York and Kansas City and $3 per M. ft. in Birmingham; fir and hemlock higher in Minneapolis. General tendency of lumber and cement prices upward. Seed shortage caused advance of 12c. per gal. in linseed oil in New York and 18c. in Chicago, since March; rise general throughout the country.

Declines—Aside from slight decreases in fir and hemlock lumber in Kansas City and Denver, few price declines were reported during month in mine materials and supplies.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed No. 10	$2.65@3.35	$4.25	$4.15	$4.60	$4.34
Black No. 28	3.50@4.00	5.00	5.00	5.90	4.90
Galvanized No. 28	5.00@5.25	6.00	6.10	6.75	5.90

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$40.00	.....	$43.00
Standard openhearth rails	43.00	40.00	$43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, $\frac{5}{16}$-in. and larger	$3.15	$2.20@2.25	$3.00	$3.90	$4.85	$3.29
Track bolts	4.00@4.50	2.90@3.00	4.00	5.00	5.85	4.29
Standard section angle bars	2.75	1.40@1.50	2.75	3.75	4.10	2.94

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.45@2.75	$2.40	$3.44	$4.50	$3.35	$3.30	$3.60
Channel, 3 to 15 in.	2.45@2.75	2.40	3.44	4.50	3.35	3.30	3.60
Angles, 3 to 6 in., $\frac{1}{4}$ in. thick	2.45@2.75	2.40	3.44	4.50	3.35	3.30	3.60
Tees, 3 in. and larger	2.45@2.75	2.40	3.44	4.50	3.35	3.30	3.60
Plates	2.45@2.75	2.40	3.44	4.60	3.35	3.30	3.60

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	25%
Cast steel round strand rope	27½%
Galvanized steel rigging and guy rope	12½%
Round strand iron and iron tiller	10%
Plow steel round strand rope	40%
Special steel round strand rope	35%

	New York	Cleveland	Chicago
Drill Rod (from list)	55%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD—	½ to 3	64	52½	¼ to 1½	30	13
LAP WELD—	2½ to 6	61	49½	4½ to 6	26	11

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	51%	59½%	49%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$58.50	$47.30	$47.00	$57.20	$52.60	$60.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.00	$2.75	$2.50
Cold punched, sq., per 100 lb. Off list	1.00	2.75	2.50

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1314	$0.1112	$0.0674	$0.125	$0.09	$0.108	.....
6x12x12	.1971	.1667	.0926	.....	.118	.156	.....
8x12x12	.2463	.2084	.1263	.19	.16	.244	$0.2362

MACHINE BOLTS—	New York	Cleveland	Chicago
1½ and 1¼x3 in. up to 12 in.	20 %	50%	50%
Button head bolts, with hex. nuts	15 %	$3.90 net	.....

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$38.00	$39.00	$40.00	$43.00
3x6 and 8	38.00	39.00	40.00	43.00
4x4-6 and 8	38.00	39.00	40.00	43.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$52.00	$53.00	$54.50	$56.50
3x10 to 10x10	56.00	57.00	57.50	59.50
3x12 to 12x12	60.00	61.00	60.00	62.50

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir
Boston	$67.00	$125.00	$65.00	$65.00	$90.00	$140.00
Cincinnati	45.00	51.50	51.50	51.50	45.00	53.50
Montreal	50.00	.....	.....	.....	95.00	90.00
Denver	.....	40.75	39.75	.....	.....	42.75
Minneapolis	46.50	44.75	41.50	.....	49.00	45.75
Kansas City	45.75	44.75	44.75	.....	58.75	48.75
Birmingham	35.00	.....	.....	.....	43.00	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.80@3.00	$3.45	$4.20	$4.25	$3.19	$4.95
Cut	3.25	5.50	5.80	5.75	3.24	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.70@2.80	$2.60@2.70	2.40
Chicago, f.o.b.	2.20	2.20	1.97
Cleveland, f.o.b.	2.46	2.46	2.26

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel 280-lb. net Common
New York	$16.80@$17.10	$13.10	$3.75	$3.00@$3.25
San Francisco	22.00	16.00	....	(180-lb net) 1.75

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$1.13	$0.82@0.83	$1.25	$0.90

WHITE AND RED LEAD—Base price in cents per pound:

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Dry or In Oil	White Yr. Ago Dry or In Oil
100-lb. keg	14.25	15.75	12.25	13.75	14.25	12.25
25 and 50-lb. kegs	14.50	16.00	12.50	14.00	14.50	12.50

HOSE—

Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled	50c per ft.

Air	First Grade	Second Grade
¾-in., 3 ply per ft.	$0.31	$0.22½

Steam—Discounts from List

First grade.... 40-10-5% Second grade.....50% Third grade.....50-10%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition..... 65% Best grade..... 60%

LEATHER BELTING—List price per ply, 12-in. wide, per lin. ft. $2.88.

Grade	Discount from list
Medium	30–10%
Heavy	20–5–2½%

RAWHIDE LACING—For cut, best grade, 40%, 2nd grade, 50%. For laces in sides, best, 48c. per sq.ft.; 2nd, 43c. Semi-tanned: cut, 40%; sides, 48c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¾ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils.

Atlanta	$0.18¾	New Orleans	$0.18¼
New York	.18	Seattle	.18
Chicago	.18	San Francisco	.18

COTTON WASTE—The following prices are in cents per pound:

	New York	Cleveland	Chicago
White	10@13	15.00	11.25
Colored	7@12	12.00	8.00

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.30
Minneapolis	.189	.2094
Denver	.2025	.2325
Seattle	.165	.195
Cincinnati	.22	.25
New Orleans	.235	.265
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.90
Pine oil, pure, dest. dist. f.o.b. New York	.85
Pine tar oil, ref. f.o.b. New York	.46
Pine tar oil, crude, tank cars f.o.b. Jacksonville, Fla	.35

NEW MACHINERY AND INVENTIONS

Unique Dumping Scheme Planned in New Coal Pier

A new electrically operated coal pier with a unique dumping scheme will be erected by the Virginian Railways Co. at Sewell's Point, Norfolk, Va. The operating machinery will be furnished by the Alliance Machine Co., of Alliance, Ohio, and the contract for the major part of the electrical equipment has been awarded to the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

In the dumping operation planned for the new coal pier, the loaded railroad cars will be hauled up an incline into the dumping position by a hoisting machine with a small cable-connected, narrow-gage car, known as the "mule," running between the standard-gage railroad tracks. The car dumpers will then turn the cars over, permitting the coal to fall into containers, called elevating pans. As the empty cars are returned by the dumpers, the loaded elevating pans, acting as counterweights for the cars, will be raised to the top of the pier. These pans, raised to the top of the pier, will then deliver coal to motor-driven cars, known as transfer cars, which, running along the top of the pier, will deliver the coal to the boats through loading towers.

This installation will be unique in that neither the railroad cars nor the transfer cars will be hoisted to the top of the pier. The handling scheme planned eliminates the necessity of elevating the transfer cars without resorting to the heavy and expensive construction required when the road cars are hoisted in the dumping operation.

The electrical equipment for the car dumpers includes four 325-hp. motors for hauling the railroad cars into the dumping position; four 450-hp. motors for dumping the cars, and a number of smaller mill-type motors for the auxiliary motions. Each of the transfer cars will be equipped with four 40-hp. motors with series-parallel control.

A New Gondola Car Unloader

A new gondola car unloader, for which efficiency and simplicity is claimed, has been designed and is being built by the Link-Belt Co., of Chicago. When a car of coal or other material is being unloaded, it is supported by a long, fixed platen upon which the entire side of the gondola rests when being rotated. At the same time, and operated by a time switch, the top clamps descend and hold the car on the rails by an absolutely equalized pressure at all four points. The dumper then turns over, discharges its contents into a pit or hopper below, returns to an upright position and automatically releases the car, thus making it ready to be pushed off.

INDUSTRIAL NOTES

Waller Crow, Inc., 327 South La Salle St., Chicago, announce that A. W. Catlin is now connected with their organization in the capacity of vice-president. Mr. Catlin is a graduate mining engineer, class of 1897, of the University of Montana. He was consulting engineer on mechanical and electrical work and sales engineer for various large organizations from 1897 to 1906. From

A. W. Catlin

1906 to 1916 he was assistant to the general European manager for Fraser & Chalmers, Ltd., of London, which concern later disposed of its interests to the General Electric Company, Ltd., of England. Mr. Catlin is an authority on European industrial methods and practices. He redesigned the cement plant of the Cia. General de Asfaltos y Portland "Asland," Barcelona, Spain, and has supervised construction and remodeling of many large industrial plants in Europe as well as in the United States. Among them are the Ebro Irrigation & Power Co. cement plant, Spain; Aberthaw & Rhoose Portland Cement Co., Ltd., a stone-crushing plant at Cardiff, Wales; the French Government naval basins; stone-crushing plant, Toulon, France; and the Tscheliabinsk Gold Mining Co., a gold-milling plant employing the the cyanide process, at Tscheliabinsk, Russia. His examinations of phosphate, cement, coal, clay, and other properties in the United States have been numerous and have covered a wide range.

The West Virginia Rail Co., Huntington, W. Va., is to add another unit to its plant for the manufacture of frogs and switches, steel mine ties, and steel mine timbers. The addition will cost about $250,000. Deliveries of this class of material can be made within the next six months, in the opinion of the management of the company.

The Mine & Smelter Supply Co. announced the appointment of Malcolm H. Carpenter as manager of its El Paso branch, to succeed Jay L. Harman, recently resigned. Mr. Carpenter was first employed by the company as a salesman in its Salt Lake City branch, and at the time the San Francisco office was opened was placed in charge of it.

The Pennsylvania Crusher Co., of Philadelphia, has recently opened a branch office in Chicago. Temporarily this is situated in the Monadnock Building, but after May 1 will be at 230 South Clark St. C. S. Darling, formerly editor of "Rock Products," will be in charge. The company manufactures heavy-duty coal-preparation machinery, and heavy steel frame hammer mills and single roll crushers for crushing limestone, cement rock, shale, and gypsum.

TRADE CATALOGS

Crushers—Bulletin No. 1005 of the Pennsylvania Crusher Co., Philadelphia, has just been issued describing primary and secondary crushers for cement rock and limestone, and the company's machinery for the preparation of coal.

Recording Instruments—A nine-page folder, entitled "Facts About Fuel," just issued by the Uehling Instrument Co., of 473 Getty Ave., Paterson, N. J., gives data on combustion and points out the uses for Uehling recording instruments about the power plant.

Motors—Motors for Westinghouse-Baldwin mine locomotives (900 series) for 80-, 125-, 250-, and 500-volt circuits are described in a four-page bulletin, No. L1765, issued by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Generators—Bulletin L2390-A of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., describes Type E engine-driven alternating-current generators made by the company in capacities ranging from 50 to 3,000 kva. and constituting a standard line of 60-cycle alternators. They are applicable to all prime movers.

Conveyors—The Mellin belt conveyor troughing and return idlers are described in a four-page bulletin, No. 3A, which has just been issued by the Chillingworth Engineering Corporation, 143 Liberty St., New York. Each pulley is fixed on a solid steel shaft. All parts of troughing idler are interchangeable; likewise bearings and bearing boxes in troughing and return idlers.

Conveyors — The Chisholm - Moore Manufacturing Co., of Cleveland, Ohio, has become the sole distributor of the Atlas Carryall track system. It has issued a new circular and a complete book of instructions detailing all the steps necessary in making installations, in order that prospective users may readily determine what they need.